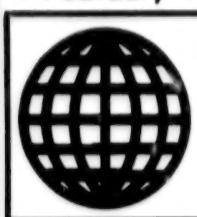
JPRS-UST-95-003
1 February 1995



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JPRS Report

Science & Technology

Central Eurasia

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Science & Technology
Central Eurasia

JPRS-UST-95-003

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Decline in Military Orders Breaks Design Bureau

957A0007A Moscow IZVESTIYA in Russian
1 Dec 94 p 5

[Article by IZVESTIYA correspondent Yaroslav Shimov: "The Design Bureau Is Waiting, but the Designers Are Getting in the Accounting Office Certificates on the Failure to Receive Wages and Are Presenting Them to the Ticket Collectors on the Bus"—first paragraph is IZVESTIYA introduction]

[FBIS Translated Text] The President hugged the designer, exchanged kisses and presented him with the shoulder boards of a major general. All of Russia saw these television pictures several times: The 75th birthday of Mikhail Kalashnikov, the developer of the world famous small arm, was celebrated with the proper splendor. Mikhail Timofeyevich, undoubtedly, is the pride of Russia. But, alas, not all of his colleagues, who are also far from untalented, can take pride in the greatest attention. Several, like the collective of the design bureau of the Moscow Salyut Production Association, are unable to get from their own state even what they have already managed to earn.

The Eyes and Ears of the Navy

Not that long ago more than 1,000 people worked at this design bureau, which is located on a street with the bold name "Highway of Enthusiasts." As Valeriy Shlepnin, chief of the design bureau and USSR State Prize winner, asserts, today the designers are also not without work. Their only trouble is that 95 percent of the developments of the design bureau are being used for the needs of defense.

The Salyut Interbranch Production Association, which includes a plant and the design bureau, equipped the domestic navy with "eyes and ears"—radar systems, information gathering and processing systems, and other devices, without which a fighting ship is a useless vessel. After the disintegration of the USSR, the Salyut Design Bureau became the only developer in Russia of such instruments for the Navy. Orders,although fewer, continue to arrive. The participation of the designs developed here in last years arms exhibition in Abu-Daby was one of the last high points of Salyut. Incidentally, Salyut is on the list of enterprises of the military-industrial complex that are not liable to privatization.

At the entrance to the building of the design bureau there hangs a poster: "Government! Repay your debts!" For more than one month the designers have been living under this slogan. Clients, particularly the radio engineering directorate of the Navy, owe them about 1 billion rubles [R] for already performed work. More precisely, R980.9 million since the beginning of this year, of which about R100 million has been paid. The amounts for present times are insignificant, but without them the associates of the bureau who have not yet taken leave, in their own words, would be living by begging.

"Who have not yet taken leave" is not a slip of the tongue. Now less than half of the former staff works at the design bureau. Vladimir Belyayev, the head of one of the divisions of the design bureau, recalls his former associates: One, a high-class programmer, took up small-scale trade, another one, a woman, got a job as an adviser at a bank, a third man, a jack of all trades, thus far has not taken his leave, but mainly does work at home—he repairs televisions and tape recorders for neighbors. Young people, who have gotten tired after seven months of waiting for their pay (the last time they paid it was on 25 May—for April), of being destitute and of working on mere enthusiasm, of which practically none remains, are leaving first of all.

The average wage, which they should pay an associate of this design bureau, based on the standards envisaged by defense orders, comes to six minimum wages, that is, a little more than R120,000. For precisely this small amount of money the designers have been waging a desperate struggle many months long, envying the "comfortable" life of not only the sellers of commercial stalls, but even retirees.

If No One Has Money, Where Is One To Get It?

The clients meanwhile are throwing up their arms: We know, they say, that we owe you, but we cannot do anything, there is no money to speak of. "Go to the bank," they advised Valeriy Shlepnin back in the spring, "get credit, and when we get the money, we will pay you everything—both interest and credit, and there will be enough left for wages...." The design bureau began to live from loan to loan. But assets as before are not coming from the subdivisions of the Ministry of Defense, and the banks are demanding repayment of the loans.

Thus, there are no funds. In turn, there are a large number of foolish financial actions that are complicating the bitter life of the blameless design bureau. For example, foolish action number one: The cost of every development is calculated in the prices that exist at the moment of receipt of an order, but at times more than a month passes from receipt to completion of work. The indexing of the fee for completed work is constantly late. (True, the designers do not even see the money that has been been reduced by inflation.)

Foolish action number two is even more stinging. The tax inspectorate is continuing to conscientiously add penalties to the taxes that have not been paid by the design bureau from the amounts not received from clients. Although there is a decision of the Russian Federation government of 15 July of this year which stipulates in such cases the exemption of defense enterprises from the payment of taxes.

The magical word "conversion" evokes sour smiles on the faces of the people from the Highway of Enthusiasts. The design bureau tried to get civilian orders. They showed me interesting developments: a multi-purpose kitchen machine that is produced here, at the "Salyut"

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plant, diagnostic instruments for medical personnel or, for example, the design of a plant for the production of expensive feed proteins from the waste products of the fishing industry, which was developed jointly with specialists of the Ministry of the Fish Industry.

None of these projects has a future for the same banal reason: There is no money. It is unprofitable to invest assets in production. Such is the consequence of foolish action number three, which is striking a painful blow to the entire Russian "defense industry": They hit upon the idea that instead of tanks and radar sets it is possible to make more peaceful and useful things, but they did not think how to provide money for the launching of production.

A Love Affair With the President. In Letters and Resolutions

When economic levers do not work, it is necessary to master the genre of tearful entreaties. Despaired of receiving what was promised by members of the military, the design bureau corresponded with the highest officials of state. The first letter addressed to President B. Yeltsin was sent on 3 August, the second was sent exactly two months later. The authorities reacted: With respect to both letters First Vice Premier O. Soskovets gave instructions to the Ministry of Defense, the State Committee for the Defense Industry and the Ministry of Finance "to take the necessary steps." That is, using human language, to give the designers money.

Things, however, have not changed. The love affair in letters is continuing: The collective of the design bureau has prepared a third message to the president.

While the authorities are thinking, the designers are incessantly repeating a phrase from an advertising roller: "To the first star! We are waiting...." And they are getting in the accounting office certificates on the failure to receive wages and are presenting them to the ticket collectors on the bus: They cannot afford to pay the fare.

Life for the associates of the design bureau turned long ago into a school of survival. One of them, for example, lay in the hospital—not so much to improve his health as to...eat—there is, after all, free food there. Another during his free time (seeing that there is enough of it—at the design bureau there is a four-day work week and a shortened workday) goes to the personal property market in Luzhniki and helps merchants load crates with goods. Another colleague of theirs engages himself in petty trade, as well as helps from time to time friends from a computer firm and gives them advice—it is a job that is connected if only some way with his main occupation....

Thus they live, more precisely, exist—some people are trying to earn money on the side, some are slipping deeper and deeper into debt, while some, however strange, continue to put their trust in the state and in the fact that the long awaited money will all the same be paid and life will become, if only a little, more normal.

To Live or Not To Live—That Is the Question

"I would gladly close down the design bureau," Valeriy Shlepnin assures us, "today, if you like. Why torture people and be tortured myself? I, after all, also cannot properly perform my duties. I cannot demand from people not so much good work, if only any work: In the end they are not obliged to dig in for 'nothing,' living on the money of relatives and friends."

But, according to existing regulations, the director can close down an enterprise, if his subordinates do not have work. The designers have something to keep busy with—for the present a navy exists in Russia. Incidentally, there is also another way: To abandon domestic equipment and to buy the same radar systems at three times the cost from western firms—Thomson, Marconi and others.

The people, who have been waiting half a year for their wage of 120,000 rubles, no longer care about politics and thoughts about economic priorities and national interests. Sitting in half-empty offices with dilapidated furniture and rather old computers, they are thinking only about one thing: How are they going to live?

Academicians Praise Soros Fund, Competitive Grant System

957A0007B Moscow POISK in Russian No 45, 12-18 Nov 94 p 1

[Article by Oleg Basalin]

[FBIS Translated Text] Vladimir Skulachev, chairman of the Russian Consultative and Observation Council of the International Science Foundation and a member of the executive committee of the International Science Foundation [ISF], uttered the mysterious word, which was placed in the title, at a meeting of the presidium of the RAS [Russian Academy of Sciences]. One of his friends, a Swedish biochemist, invented this neologism. An anastrophe is something opposite to a catastrophe, an unexpected spontaneous event, but with a plus sign. Skulachev called the appearance of Soros, rather, his money, to Russian science an anastrophe.

Academician Vladimir Skulachev and Professor Alexander Goldfarb—the people at the helm of the ISF—visited the academy a few days ago not only to report to the members of the presidium on the work done by the foundation. In the words of Alexander Goldfarb, director of foreign operations of the International Science Foundation, during the initial period of operation of the Soros Fund some distrust and cautiousness with respect to it on the part of the academy were felt. Therefore, it was important to find out what the opinion of executives of the RAS was about the activity of the International Science Foundation now, after two years of its operation in Russia.

Here are just a few quotations from the statements of members of the presidium of the RAS, who assessed the foundation and its affairs.

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Academician Yuriy Osipyan:

"I must regretfully state that I belonged to the category of people who treated this initiative with caution. This caution was based on distrust of the grant system as a whole. We believed that we should ourselves distribute money within the academy and that another system of financing would lead to the destruction of our infrastructure, scientific schools.... I admit that I was greatly mistaken. What we have today in the person of the ISF is progressive and very significant. Owing precisely to the diversity of systems and methods of financing we will be able to help domestic science."

Academician Yevgeniy Velikhov:

"A community of many countries is trying to help us. Moreover, quite unsuccessfully—as soon as organizational difficulties arise, the matter immediately comes to a stop. I was myself a witness to how in 1992 the decision on the establishment of a fund to aid nuclear scientists was made at Camp David. Moreover, this was done at the highest level—the presidential, governmental level. Thus far not a kopeck has been spent by this fund. How and when it will be spent is unknown. The mechanism, which was developed at the state level, proved to be ineffective. If you look at the other programs of aid to our science, you can see that in the majority of them the funds also do not reach their destination and often settle in various 'acquainting' groups. But then the system, which was developed with the ISF proved to be viable, and it is necessary to use it without fail in the future."

Academician Aleksandr Spirin:

"There exist a large number of foreign projects of support for Russian science, which are spinning and will spin their wheels—in contrast to the ISF. Without the knowledge of Russia and of our manners, which the organizers of the Soros Fund demonstrated, this mechanism would not have begun to work. The fund has played an enormous role in the fact that our science has not yet perished. It has helped not only with money, but first of all psychologically—it has given hope...."

"We should unite in order subsequently to exert the maximum efforts when trying to get money," that is how Academician Spirin concluded his emotional speech. This day the guests from the ISF told the members of the presidium about the further intentions of George Soros. Back when beginning his $100 million program, the American patron proposed to continue it, having pulled in "outside forces."

"George Soros believes that such a program cannot be the result of the activity of just one person," Alexander Goldfarb noted. "The participation in it of state budget assets should underscore its significance."

We have already reported that Soros proposed "to go shares" without government, and as a result our science will receive another $25 million. This money will be spent in 1995. In order to continue the program of trips of our scientists abroad, Soros has promised another $4 million. But they will end by the beginning of 1996. What then?

Soros is prepared to allocate another $20 million for 1996-1997, but only if the Russian government allocates the same amount and the American administration gives just as much. In all, $60 million.

The appearance in the formula of the third component altered the working plans of the functionaries of the ISF. Now they also have to make the rounds of the offices of the authorities across the ocean. "When we come to a deputy secretary of state or to an influential senator and try to persuade them that the support of the intelligentsia and the basic sciences in Russia is no less important than the dismantling of missiles, they ask us: And who can confirm this?" says A. Goldfarb.

In order to continue the program and to attain the appropriation of money, the ISF needs support, moreover, strong support, on the part of authoritative forces. The RAS, to which the representatives of the ISF were invited, is precisely such a force. And, it must be said, they found understanding there.

St. Petersburg S&T Institutes Seek Local Support

957A0007C St. Petersburg NEVSKOYE VREMYA in Russian 24 Nov 94 p 1

[Interview with Eduard Tropp, chief scientific secretary of the St. Petersburg Scientific Center of the Russian Academy of Sciences, by Arkadiy Sosnov; place and date not given: "The Rejection of Alms"]

[FBIS Translated Text]

Sosnov: There exists the popular opinion that, inasmuch as St. Petersburg institutes of science and the higher school are under federal subordination, first of all Moscow should take care of them. Do you share it?

Tropp: Only in the sense that St. Petersburg science is not regional. It belongs to Russia and the world. But this does not at all mean that the city should devote attention to it only in accordance with the contribution to the municipal economy.

The fact that science is one of the urban development sectors of St. Petersburg, is not fine words for a report of the mayor at some top level, but a concrete truth. Science always was a support for our industry in the assimilation of high technologies and in the development of new models of equipment and for advanced St. Petersburg medicine. But what determines the spiritual atmosphere of the city and the county, if not the humanities scientific and educational centers of St. Petersburg? Our science is not required to prove its particular services to the mayor's office, so that it would remember it more often.

Sosnov: A meeting of the government of St. Petersburg "On the State of Science and the Higher School" is planned in January. How do you appraise this state?

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Tropp: As a difficult one. The increase of the share of wages in the structure of the spending of academic institutes is continuing—only a few percent remain for materials and equipment. And this is given the fact that the wage of scientific personnel comes to 68 percent of the average wage for the city! Such dissimilar institutions as the Institute of Nuclear Physics and the Institute of Socio-economic Problems have come close to each other in spending per associate. All of us, alas, are becoming producers of texts....

But science has not yet died, and for this reason problems remain! The St. Petersburg scientific community is making desperate efforts to maintain its authority throughout the world. And it is confirmed by objective indicators, by the number of received grants, papers at international conferences, and so on.

Sosnov: What decisions do you expect from the government so that these indicators would not decrease?

Tropp: Frankly speaking, we are asking for money. And not alms, but the establishment of a precise mechanism of the financing of science on the part of the city authorities, the creation of conditions, under which it would be profitable for private capital to invest in research. It is necessary to revive the program "The Scientific and Technical Potential of St. Petersburg." We are insistently repeating our request to assign scientific institutions to the group of budget-carried organizations, for which the rates for municipal services have been reduced. In Moscow this, thank God, has been implemented.

We are seeking the transfer to academic institutes of the buildings and premises which are leased from the Committee for the Management of City Property—after all, the corresponding Edict of the President of 21 November 1991 has thus far not been fulfilled. I understand that they have been waiting three years for what was promised, but will not much longer....

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Decree on Use of Baykonur Cosmodrome

957Q0016A Moscow ROSSIYSKAYA GAZETA in Russian 1 Nov 94 p 4

[Decree by B. Yeltsin: "Organization Of Further Use of Baykonur Cosmodrome in Interests of Russian Federation Space Activity"]

[FBIS Translated Text] For the purpose of efficient use of the Baykonur cosmodrome for the implementation of Russian space programs and in connection with the signing of the agreement between the Russian Federation and the Kazakhstan Republic on the fundamental principles and conditions for use of the Baykonur cosmodrome it is decreed that:

1. The government of the Russian Federation is to organize the takeover of the Baykonur complex from the government of the Kazakhstan Republic and will ensure its operation. Within a month's time nominations for the post of administrative head of Leninsk city will be prepared. In the preparation and refinement of the federal budget it is provided that:

- appropriations will be made for paying for the leasing of the Baykonur cosmodrome and maintenance of Leninsk city;
- appropriations will be made for the Russian Space Agency and the RF Defense Ministry for the Military Space Forces for operating expenses and purchase of standard equipment for the operation, repair, reconstruction and technical re-outfitting of facilities at the Baykonur cosmodrome and maintenance of military personnel;
- necessary amounts will be allocated for capital investments, including for the construction of residential quarters in the Russian Federation for persons discharged from the military service and performing their duties in the armed forces of the Russian Federation in the territory of the Baykonur cosmodrome, as well as for workers at enterprises and organizations permanently working at the Baykonur complex.

2. It is decreed that the financial, material-technical support and operation of facilities at the Baykonur complex used for implementing Russian military space programs is to be the responsibility of the RF Defense Ministry (Military Space Forces); the implementation of the Russian federal space program is to be the responsibility of the Russian Space Agency under agreements with the industrial enterprises and organizations and military units at the cosmodrome. The financial and material-technical support of facilities associated with support of operations at the Baykonur complex is to be divided between the RF Defense Ministry (Military Space Forces) and the Russian Space Agency on a shares basis.

3. Between 1 January 1995 and 1 January 1997 a special military contingent of 16,000 men will be maintained, including 3,800 officers, above and beyond the numbers of the RF armed forces, as part of the Military Space Forces for implementing space programs of a scientific and economic character and international cooperation, as well as operation of facilities related to support of operations at the Baykonur complex using the funds allocated to the Russian Space Agency from the federal budget. The RF Defense Ministry will ensure manning and support of the indicated military contingent with all types of allowances.

4. The overall coordination of work carried out at the Baykonur cosmodrome is to be assigned to the RF Defense Ministry (Military Space Forces).

5. This decree will enter into force from the day of its signing. [signed] B. Yeltsin, President of the Russian Federation, the Kremlin, Moscow, 24 October 1994. No 2005.

Plans, Programs of Polet Association Outlined

957Q0022 Moscow ROSSIYSKIYE VESTI in Russian 10 Nov 94 p 8

[Article by Vladimir Igolkinev, special correspondent for ROSSIYSKIYE VESTI, dateline Omsk: "New Strategy for 'Polet'"]

[FBIS Translated Text] The Polet Association is the only Russian rocket-space complex that independently showed its technologies and conversion programs at the air show in Fairnborough (Great Britain). Its participation in the show adjusted considerably its strategy for the association's entry into the world market.

That pertains primarily to the use for commercial purposes of the light-class rocket Kosmos, the world's cheapest and most reliable system for delivering various types of facilities weighing 300-1500 kg to orbit. We've been launching those rockets for almost a quarter of a century, and a multitude of satellites have been placed into near-Earth space with them. In the United States, it was only recently that a rocket of that class was tested. The launch ended in failure and cost the taxpayers $25 million. The road-tested Polet program is considerably cheaper.

A concrete result of the participation in the air show was the signing of two contracts with American and Swiss firms; preliminary negotiations with those firms had been going on for several months. US and Swiss satellites will be placed in orbit from Russian launch facilities before the end of the year by rockets built in Omsk. That became possible after the COCOM system of bans was lifted by the West. So the road to "space" commerce is now open. Polet has already purchased from a Russian trade agency the license for the five-year rights to use the Kosmos rocket to launch domestic and foreign vehicles and for the sale of services involving the creation of low-orbit satellite communications systems. All that is the result of the steady personal contact between the two presidents—Yeltsin and Clinton—and especially the last visit of the Russian leader to the United States.

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Glonass Constellation Said Finished in 1995

957Q0028A Paris AIR & COSMOS/AVIATION IMTERNATIONAL in French No 1496, 2 Dec 94 p 46

[Article by Christian Lardier: "Russian Glonass Complete in 1995"]

[FBIS Translated Text] *Russia's Glonass navigation system, involving 24 satellites, will be operational as of the next launch in 1995.*

On 20 November, at Baykonour, Russia launched three Glonass navigation satellites (Cosmos-2294, -2295, and -2296) aboard a Proton rocket. They were the 19th, 20th, and 21st satellites of the complete constellation. The constellation will consist of 24 satellites distributed over three orbital planes at 120° intervals, with seven active satellites and one reserve satellite in each plane. Since 1982, Russia has launched 25 groups of 3 satellites each. Two or three of these groups failed to reach their orbits because of a failure of the fourth stage (Bloc-DM2). In 1991, the system was limited to 12-13 satellites on two orbital planes. The system was nevertheless turned over to the army on 24 September 1993. But with the forthcoming launch around the beginning of 1995, the operational system will finally be complete, in the manner of the American Navstar/GPS [Navigation System Using Time and Ranging/Global Positioning System]. The 1,300 kg satellites were designed by Krasnoarsk's NPO [Scientific Production Association] of Applied Mechanics, and are built on a production-line basis by the "Polet" plant at Omsk, Siberia. They operate in Band L and have an operational life of 3 to 5 years. The operational system permits location with a precision of 10 meters. But in open-access mode, for civilian users, its precision does not exceed 100 meters. The Navstar/GPS system has been operational since the launching of the 24th and last Rockwell Block-2 satellite on 10 March. Ten Block-1 satellites had been launched between 1977 and 1985. In 1996, the United States will commence putting in orbit the 20 Martin Marietta Block-2 satellites, to which six Gapfiller/GPS satellites will be added. Around the end of 1995, the USAF is expected to decide on the succeeding Block 2F generation, which is to be launched beginning in year 2002. In August, the Rockwell-Hughes team received $4.7 million (25.8 million francs) to modernize Russian air control by assisting it, among other things, to utilize GPS receivers. In Europe, Inmarsat plans to install GPS repeaters and Glonass on board the five Inmarsat-3 satellites that are to be launched in 1996-1997. The channels were allocated on 23 November to DBP Telecom in Germany, France Telecom, Comsat in the United States, and Teleglobe in Canada. Japan plans to launch two MTSat geostationary satellites in 1999 and 2004, to relay the GPS's and Glonass. China, for its part, plans to launch two TwinStar geostationary navigation satellites around 1998.

History, Outlook for Baykonur Described

957Q0030A Paris SCIENCE ET VIE in French No 926 Nov 94 pp 106-109

[Article by Jacques Villain: "Baykonur: Grandeur and Decadence"—first paragraph is SCIENCE ET VIE introduction]

[FBIS Translated Text] A formidable space facility, Baykonur was built on the typically Russian scale—with huge investments in resources and expertise. Since the death of the Soviet Union, it has gathered dust, and become a breeding ground for disease and bitterness. Will it get a second wind?

Russia, after protracted negotiations with Kazakhstan and agreeing to pay rent ($115 million for a 30-year lease), has managed to hold onto its Baykonur cosmodrome. But Moscow is also going to have to finance restoration and maintenance of the infrastructure, some of which is in very poor condition. Baykonur, in fact, is close to becoming a modern Pompeii [1]. The end of the Cold War was almost a fatal blow.

It was designed in 1954, at the height of the Cold War, when Russia decided to build an intercontinental ballistic missile, the R7 Semiorka. This type of rocket required a base designed to protect its launches and the entire flight trajectory from prying Western eyes—especially American radars in Turkey. The Kapustin Yar base, near Volgograd, in service since 1946, was unsatisfactory. So the choice fell on the Kzyl-Orda region of Kazakhstan, near Tyura-Tam, a small railroad station lost in the immensity of the steppes. On 12 January 1955, about thirty soldiers arrived to begin surveying.

In February, the road linking Tyura-Tam to the launching pad—"Site No. 1," as it was called—was built. On 5 May, the military engineering units arrived, the first of some 5,000 soldiers. In addition to the launch site itself, plans were made for two radio guidance installations, nine centers for radio guidance, telemetry, and tracking, and an operations support infrastructure. But first, the road and rail links had to be put in place. Between Tyura-Tam station and the Syr-Daria river were built the first wooden habitations of what was later to become an entire city, Leninsk. Situated some thirty kilometers from the cosmodrome, Leninsk is where the people who worked at Baykonur would live.

But the first teams lived in tents, working day and night in temperatures ranging from 50°C. in summer down to -30°C. in winter. Construction went forward simultaneously at several sites, even before the rail lines, the roads, the water and power lines were completed. Vehicles left the rail station at crack of dawn carrying materials and structural parts over roads not yet asphalted. Hard freezes and icy winds complicated earth-moving operations. Hundreds of trucks, dozens of digging machines and bulldozers ran 24 hours a day. The logistics alone were a considerable challenge, from the immense sawmill, its companion wood-treatment

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facility, and the concrete plant to the colossal garage sheltering thousands of vehicles. At the work site, people recall, it was only the machines that broke down—not the workers.

The launch site was on the flank of a hill, to make best use of the site's topography. One million cubic meters of earth was moved in 3 months. Electricity was provided by a steam generator mounted on a special train. The Leninsk thermal powe plant, which was to provide electricity for the entire cosmodrome complex, would not be operational until 1956.

By 1 November, a little over 6 months after work commenced, the entire rail and road network was completed. Between April and September 1956, 30,000 cubic meters of concrete was poured for the launch pad. During this same period, the launch vehicle erection system and the four-armed, hinged launch tower were developed at the Leningrad engineering plant, which was given 12 months to complete the installation; it was ready in less than 6. Static and dynamic tests were carried out in Leningrad, since Tyura-Tam did not have big enough cranes. They even simulated a real launch. Test results proving satisfactory, the system was sent to Tyura-Tam to be assembled at the launching pad.

In April 1957, the base was accepted by a state commission. The final inspections took place just days before the first launching of the R7 rocket on 15 May 1957, a launch that validated 2 years of herculean labors. The whole world learned of it, though no one at the time knew the Baykonur cosmodrome was actually situated 370 km southwest of... Baykonur! Soviet space publications invariably situated the facility at 47.4°N, 63.4°E., rather than 45.6°N., 63.4°E. By 1975, that attempt to deceive the West began to be seen for what it was, with the first visit of foreign journalists for the Soviet-American Soyuz-Apollo flight. But as early as 1957, a Japanese astronomer had discovered the actual location of the cosmodrome. Since 1991, and the advent of the CIS [Commonwealth of Independent States], the official appellation has been Tyura-Tam.

The period from 1957 to the mid-1960s witnessed a succession of great "firsts": first satellite, first man in space, first woman in orbit, first "spacewalk," first photographs of the far side of the moon, etc. In 1960, Baykonur's Site No. 1 was modified to make it compatible with the launcher for the manned Vostok module.

Between 1960 and 1964, it was decided to go ahead with two new launcher programs. First, the Proton, capable of lofting into orbit heavy cargos such as the envisaged Almaz and Salyut space stations. In the 1960s and 1970s, two Proton launch complexes, each equipped with two launch pads, were built about thirty kilometers west of Site No. 1. The first went into service on 16 July 1965 with the launch of the scientific satellite Proton-1. In 1970, the second complex went into service. But it was the second program, the N1-L3 moon rocket, that ate up the lion's share of resources. Because funds were tight, the two initial complexes were reduced to one. About seven kilometers from there were situated the technical support zone and living quarters for "Progress," the industrial [state] enterprise responsible for assembling the complete launch vehicle, fabricating important subsystems, and conducting tests. Every day, two trains dozens of cars long arrived laden with materials. The construction site was so gigantic it became an attraction for visiting delegations from fraternal socialist countries.

In January 1969, preparations for the first launch of the lunar launcher lasted 28 days and involved 2,300 people. Liquid oxygen deliveries alone required 50 tank-cars. But after four launch failures, the Soviets abandoned their ambition to land on the moon.

The ex-USSR was most active in space between 1976 and 1986. During that time, the Soviets sent 150 satellites into orbit, of which 80 to 90 percent were for military use. In some years, there were as many as three or four launches per day! Semiorka/Soyuz, Semiorka/Molniya, Proton, Cyclone, and Zenith—plus Energia/Burane, starting in 1987—were launched from Baykonur. But some Semiorka/Molniya, Cosmos, and Cyclone were also launched from Plesetsk, the other space center, situated about 800 km north of Moscow.

Like the other bases, Baykonur has always supported a mix of civilian and military activity. In the domain of ballistic missiles, it was only a test center. The first operational anti-satellite system, Polet, was launched in 1963 by a modified Semiorka. In 1965, a new model was sent into space by a modified version of the R36 (SS9) ballistic missile. Then a special launch site for Cycle was built on the western side of Baykonur, beyond the Proton complex; it was used in 1966 and 1967 for tests on the FOBS (Fractional Orbital Bombardment System), and, beginning in 1967, for tests of the anti-satellite system.

The latter consisted of putting into orbit an interceptor satellite equipped with a homing head capable of identifying the target satellite and moving into its orbit to deliver a fragmentation bomb. Before the system was abandoned in 1982, 20 "satellite-killers" were launched, with 13 successful interceptions. The Cyclone launcher malfunctioned only twice in more than a hundred launches.

Baykonur does not hold the record for the greatest number of Soviet and/or Russian launches; the winner is Plesetsk, which has been responsible for about 60 percent of them. Nevertheless, between 1957 and 1993, about 950 satellites were launched there, an average of 26 launches per year, or more than 2 a month! In 1987, it broke all records with 45 launches. By 1993, the CIS had the capacity to support up to 230 launches (100 at Plesetsk, 130 at Baykonur)—but actually conducted only 47. Of the Semiorka launches between 1961 and 1993, 77 were manned flights.

Statistics on missile firings are difficult to verify. Between 1957 and 1992, 1,100 ballistic missiles seem to

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have been tested at Baykonur, but this number probably represents only a portion of the total tests carried out since 1947.

For many years the Soviets tried to hide all this hectic activity from "hostile" Western eyes. General de Gaulle was the first Westerner to visit Baykonur, in what the Soviets dubbed "Operation Palma." On 25 June 1966, he observed the launch of a Meteor weather satellite (Cosmos 122) and an intercontinental missile: He found the Soviet prowess frightening. On 8 October 1970, Georges Pompidou attended the launch of the Cosmos 168 spy satellite. In 1988, Francois Mitterrand came for Jean-Loup Chretien's second flight.

On 27 April 1975, the first Americans (11 astronauts and two NASA officials) arrived in Baykonur to prepare for the Apollo-Soyuz flight in July of the following year. Relations between the two countries were strained at the time. For security reasons, the American delegation arrived and departed by night, so they could not eyeball any installations other than those involved in the joint flight. Only a TASS journalist was permitted to report the event and photograph the American astronauts at the foot of the launch ramp.

Beginning in 1978, official delegations and press representatives from East Bloc countries attended every manned flight of Intercosmos. Western journalists were invited in June 1982 for Jean-Loup Chretien's first flight (Soyuz T6). American military representatives were allowed to be on hand in July 1988 for the launch of the Phobos 1 and 2 probes.

The break-up of the USSR and the end of East-West confrontation and competition in space have radically changed the objectives and the stakes in space, both in the CIS and elsewhere. So much so that 2 or 3 years ago Russia questioned whether there was any point in keeping Baykonur which, it will be recalled, is in Kazakhstan.

The decline of space activity in the CIS has led to the departure of several thousand specialists and other workers responsible for logistics and construction. Work yards have shut down, and it can no longer be taken for granted the base will continue to operate as it has in the past. Wage disparities between Russian and Kazakh soldiers have exacerbated tensions. In June 1993, 18 months after the first rebellion, a second erupted. Military huts, office suites, a hospital, and a library were set afire. Leninsk has lost more than one-third of its inhabitants, a calamity for the local economy. Insecurity and disease outbreaks have become a way of life. For lack of funds, facility maintenance was neglected. This showcase of technological success is sliding into stagnation and bitterness.

This is why the Energiya-Buran system will not be revived anytime soon. Even if new missions and financing are found, it will take years to reconstitute the project teams. The Energia assembly building, where since 1989 boosters, fuel tanks, and engines have quietly gathered dust, has become, in fact, a museum. It's as depressing as the discovery, on the banks of the Moskva, of a Buran planted in the middle of a "Moon Park" and turned into a cafe!

Tremendous resources and brain-power were lavished on this would-be staging base to the stars. Humanity's loss would be great if the site were to become a simple tourist curiosity. Let us hope the accord between the Russians and Kazakhs will give a second wind to the great space adventure of Baykonur.

Footnote

1. The facts in this article are extracted from "Baikonour, la porte des etoiles" [Baykonur: Gateway to the Stars], which has just been published under the direction of Jacques Villain by Editions Armand Colin, on the occasion of the 25th anniversary of the European Propulsion Company.

Work of Russian Space Booster Builders Described

957Q0031A Moscow SEGODNYA in Russian 15 Dec 94 p 9

[Article by Mikhail Chernyshov: "The Path of 'Progress': From the Bicycle to the 'Buran.' Rocket Builders Lay Hopes on 'Rus' Like on a Snappy, Unbeatable Troika"]

[FBIS Translated Text] The Progress Plant is the chief supplier of Russian space rockets. The booster rocket for the flight of Yuriy Gagarin was constructed here, as were units for the N-1 superrocket for manned lunar expeditions and the multiply reuseable Buran ships. Half of all Russian satellites are now lifted into orbit by transport systems developed in Samara. In addition to boosters the Progress Plant also makes many satellites: Nauka, Bion, Resurs and others. The plant has constructed a total of more than 1500 boosters and more than 800 space vehicles.

The history of the plant began with a bicycle. In 1884 the German businessman Jules Muller rented a shed in the neighborhood of Sadovo-Triumfalnaya Square, transforming it into a workshop for the assembly and repair of bicycles. Later the parallel production of motorcycles was organized, as well as gasoline, steam and even electric automobiles, aerosleighs and railroad trolleys. In 1900 the firm became a joint-stock company and was given the name Duks. Translated from Latin this means "leader." Ninety years after the birth of the enterprise in the Baltic region there was an exhibit-demonstration of old automobiles at which the best-known foreign makes were exhibited and the highest marks for elegance ere awarded to the 1910 Duks.

However, business at the factory did not always go well. Duks experienced the first crisis in 1906, after the ending of the Russo-Japanese war. It was necessary to find a customer, which at that time was a military department.

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Duks departed from automobile production and shifted to aircraft production. The company achieved its highest productivity by 1915, that year constructing 450 aircraft. Still another form of defense production appeared: military dirigibles.

The plant was nationalized in 1918, but in 1923 Duks seemingly ceased to exist; however. State Aviation Plant No 1 imeni ODVF (Obshchestvo druzey vozdushnogo flota—Society of Friends of the Air Fleet), later called Aviakhim, appeared. The principal product initially was the R-1 reconnaissance aircraft, designed by Nikolay Polikarpov. In the 1940's the plant mastered the production of the latest aircraft: MiG-1 and MiG- 3, designed by Artem Mikoyan and Mikhail Gurevich.

In beginning the war the fascists, naturally, knew of the existence of the plant. A massed assault of German aircraft on the region where the enterprise was situated was organized in August of 1941. Joseph Goebbels personally, in a special radio address, announced that No 1 existed no more because Goering's aces had leveled it to the ground.

In actuality, however, the damage was minor. The government announced that the name Stalin had been awarded to the plant and made still another decision: to evacuate the plant to Kuybyshev. There a grandiose combine developed which included not only Plant No. 1, but also a local aircraft plant established here, as well as a number of aircraft plants evacuated earlier from Dnepropetrovsk, Smolensk, Tallin, Riga, Kaunas and Kiev. The principal task of this giant came to be the production of Il-2 dive bombers; in 1943 the combine produced 4500 "flying tanks."

In the postwar years the plant mastered jet technology and in 1958 after Gagarin's first launching, the plant was given the name Progress. Successes were accompanied by failures. The greatest failure was the story with the lunar rocket. Production work on this booster continued from 1963 through 1974. Gigantic structures were built specially for it at the plant itself and at Baykonur. Nine boosters were constructed, but 4 experimental launches ended in failure: the booster either tumbled over or exploded, putting an end to launches. The construction program was aborted and the remaining boosters were shipped out to be melted down. Work on the Buran ended with only one flight of the ship in an automatic made.

Today 80% of the plant production capacity is taken up with state orders. Anatoliy Chizhov, Progress general director, is not entirely happy with this situation. The power and materials for the plant are acquired at free prices, but the enterprise sells its products at fixed prices. The sums allocated by presidential and government decrees are systematically hung up somewhere. Under these conditions there can be no market. Anatoliy Chizhov feels that "the government should finally decide how much and what 'space' is needed by Russia and fund it appropriately." With respect to self-funding, the director based particular hopes on interest in the Soyuz booster on the international market. Communication systems based on small low-orbit satellites are coming into common use. The Soyuz (7 tons payload) is ideally suited for these purposes. The booster is now being substantially modified, for the most part by introducing a new control system and other electronics. It will be called the Rus. The Progress Plant is now conducting negotiations with the American McDonnell-Douglas Company on the possibility of implementation of a number of joint projects. But Anatoliy Chizhov feels that it is too early to say specifically how this will turn out. But for the time being the average salary at the plant is almost half of that for Samara and the most highly qualified specialists are continuing to depart from the "order-winning enterprise."

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Journal 'Technical Cybernetics' To Change Name

957G0013 Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 4, Jul-Aug 94 pp 3-4

[Article author not listed]

[FBIS Translated Text] Beginning in 1995 this journal will be published under the name IZVESTIYA RAN. TEORIYA I SISTEMY UPRAVLENIYA [Journal of the Russian Academy of Sciences. Theory and Control Systems]. The new name better reflects the recent subject matter of the journal, more accurately defines its scientific focus, and reflects current trends in the development of the science of control.

The journal will publish articles on control theory and control methods, as well as articles on the study, design, modeling, creation, and use of new control systems.

In addition to traditional technical applications of control theory and control systems, such as the control of aviation, missile, transportation, and robotic systems, the journal will also include articles on the control of ecological systems, physical and chemical processes, control systems for technological processes, computer information processing, artificial intelligence, system analysis, and the study of operations. The journal will be of broader appeal to specialists working in biological, humanitarian, and social sciences and those using the methods and approaches of control theory.

The subject matter of the journal will include the following areas:

- systems theory and general control theory (mathematical models, structural properties, new methods, controllability and observability)
- stability
- control in determinate systems
- information processing and identification
- control in stochastic systems and under conditions of uncertainty
- optimal control
- adaptive control
- control of systems with distributed parameters
- discrete systems
- optimization methods
- computer methods (computing algorithms, computer algebra methods, modeling)
- systems analysis and the study of operations
- artificial intelligence
- pattern recognition and image processing in the area of control systems and applications
- complex technical control systems and information control complexes
- systems to control technological processes
- navigational systems
- control systems for mobile objects (aircraft, spacecraft, ships, railroad cars and automotive vehicles, etc.)
- robotics
- microprocessors in control systems
- control system elements (sensors, drives, tracking systems)
- man-machine control systems
- automated design and manufacturing systems (CAD-CAM)
- automation of scientific research
- simulation and modeling complexes
- information and control complexes.

The journal will publish articles which reflect the current level of scientific research and development in the area of control. Attention will be focused on computer methods and technologies. In the future there are plans to continue the practice of publishing special editions of the journal devoted to current problems in control science. Overview and problem articles devoted to scientific life in Russia will be published more frequently, and the proceedings of international and Russian scientific conferences and symposia will be published.

One of the main goals of automation today is to cross the bridge between control theory, which is well-developed and complex, and the process of creating specific technical systems, linking mathematical theory and engineering practice. This goal is also the goal of the journal.

The journal is designed to interest a wide range of readers: scientists, engineers, graduate and undergraduate students in the area of control theory, information science, the study of operations and allied sciences, as well as those involved in the design and creation of new control systems.

Russian Computer Company 'IVK' Describes Operations

957G0014A Moscow NAUKA I ZHIZN in Russian No 11, Nov 94 pp 15-17

[Article by N. Dementyev, department head, IVK: "World-Class Russian Computers"]

[FBIS Translated Text]Like all our large commercial structures, the innovative corporation IVK (see NAUKA I ZHIZN, No 10, 94) has only existed for a few years. It began from a relatively small student construction cooperative that gradually grew into a powerful structure and firm encompassing dozens of rather independent financial, trade, research, information, and production companies. Recently, the entire conglomerate as a whole, and above all its component known as the Innovation Corporation [IVK], has changed its priorities and made production the its main activity in the high-technology sphere. Specifically, our large-series production of modern world-class personal computers, which we refer to as the computer project, has become one of its especially important investment directions.

IVK's computer project completed its market research phase extremely quickly (at least by our pre-reform criteria), and this past autumn it began series production of several versions of modern computers. They are

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manufactured at the privatized plant Kvant (IVK is its main stockholder) in our "electronic capital" in the Moscow suburb Zelenograd. The Kvant plant is a modern plant equipped with excellent European and Japanese equipment.

The idea underlying the manufacture of IVK computers may be formulated as follows: The computers are assembled, tried out, and tested at the Kvant plant. All their electronic units are purchased in finished form from well-recommended foreign suppliers guaranteeing high quality and reliability. In the future, the imported components may be partially replaced by domestically produced components, but only after the latter have been proven to be of high quality and certified based on international standards.

The system of acquiring units and components requires special mention because it is precisely that system that has largely dictated the already-acknowledged high indicators of IVK computers and especially their reliability.

When purchasing their component parts, we tried to completely eliminate the "cheaper-the-better" principle that allows computer production to artificially increase production profitability and raise profits. Orders for component parts are made on the basis of offers of the most reliable foreign manufacturers and are sent to them by IVK's International Purchasing Office. The components purchased by the office are randomly (5 to 20 percent) tested. If the test results are positive, the lot is purchased and certified by the National Software Testing Laboratory [NSTL], which is the main international authority evaluating "hardware's" suitability for working with the entire complex of modern software. The requirements established for microprocessor quality are especially stringent, and there IVK is insured by a special agreement with Intel, the leader in the world microprocessor market. IVK purchases its hard disk, which is another extremely important computer component, from the leading hard disk manufacturers: Western Digital (which offers a 3-year guarantee), Maxtor, and Seagate. Before new batches of components are sent off to the assembly line, a check computer is assembled and subjected to stringent testing involving a whole battery of reliability, compatibility, and productivity tests. This virtually prevents the installation of defective components in a series-produced computer, and thus guarantees a computer with high quality indicators.

One of the main tasks of IVK's computer project is keeping the quality of IVK brand computers high so that they can successfully weather the difficult competition in our market. Consequently, the Kvant plant has, in all stages of the manufacture of IVK computers, introduced a quality assurance system that is as good as the analogous systems of the world's leading firms. The following are selected components of the system that we have adopted:

- each operator along the assembly line uses a special procedure to check the quality of the preceding operator's work, and the final operator checks the quality of the computer as a whole;
- a special service computer is used to automatically load test software into each assembled computer directly on the assembly line, after which a full run of diagnostic software is made in the initial inspection stage;
- those computers that have successfully passed the aforesaid stages of the testing process are automatically sent to a thermal chamber, where they are subjected to in-depth diagnostics in a continuous cycle mode for 24 hours at a temperature is +37°C (about +50°C inside the computer);
- in all testing operations, a report on the results of each test is automatically compiled for all of the computer's units and written into its hard drive;
- in the warehouse holding finished products, sample computers from each batch are randomly selected, unpacked, and subjected to a repeat of the same complete inspection.
- statistical processing and careful analysis of all tests conducted is an indispensable component of the system.

An important component of the concept "high-class personal computer" is compatibility with all licensed software products created for the said class of computers. It is no secret that some computers, most often inexpensive ones, often lack such compatibility. Simply put, several programs will simply not run on some machines.

An NSTL quality certificate establishes the degree of operability of applications software for a specific version of a computer system, and in this respect, IVK computers are on a par with the best world class computers. Specifically, the basic models of IVK computers currently have an NSTL certificate certifying that they are guaranteed to run the popular software products without any malfunctions caused by hardware. We will mention a few of them for specialists: Microsoft Windows 3.1; DOS 6.0; Dbase IV 2.0; Paradox 4.0; Mathematica; Corel Draw 3.0; Lotus 1-2-3 for Windows; Net Ware IPX Driver; Microsoft Excel 4.0a; Quattro Pro 4.0; PC Tools Deluxe 8.0; QAPLUS 4.7; Microsoft Word for Windows 2.0; Word Perfect for Windows 5.2; and AutoCAD Release 12.

A number of objective evaluations have thus confirmed that IVK personal computers are high-class, completely reliable, and fully IBM-compatible machines guaranteed to perform a broad spectrum of tasks.

In accordance with an agreement between IVK and Microsoft, the leader in the world software market, Microsoft software is factory-installed in all series-produced IVK computers, with Microsoft offering us significant discounts. Individuals purchasing IVK computers thus save a great deal of money by not purchasing a great number of programs themselves, and they receive computers fully ready to operate, including in networks.

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A big barrier on the road to illegal copying of software has thus been erected, and the framework for a civilized market in Russia has been laid in earnest.

IVK computers with a 386DX processor are being sold to the user who already has a general knowledge of the Russian version of the Windows 3.1 environment. Windows for Workgroups 3.11 is being installed into more complex computers with processors of the 486 series. It is being done correctly so as to optimize each machine's resources, which is of great importance for beginning users. All software is supplied to the user together with distribution software (a complete set of program modules with allowance for possible modifications of the computer's configuration) and documentation written in Russian.

The standardization of the computers in the IVK family and their complete compatibility with modern standard software guarantees continuity when updating a computer pool and significant monetary savings.

It is time for a few words about the diversity of the IVK computers available to users. They are based on the ideology that is accepted worldwide and that makes it possible to modify a computer's configuration and most important characteristics within broad bounds (see pages 2-3 of the color insert [text not provided]). The computer's case contains more than enough space to hold any realistic set of components—the main (mother) board with the microprocessor and everything associated with it, network and other boards, as well as disk drives, hard disk, power supply unit, and CD ROM devices. The dimensions of all these units and boards are standardized, and the electrical connections between them are via multipin plugs. All of this has been done so that a computer can be quickly assembled "from building blocks," which is to say, so that a computer with the required configuration can be obtained by selecting a specified set of boards and units and installing them in the case. It is, for example, possible to install 1 megabyte or 16 megabytes of working memory, install one disk drive or two (or even four if someone needs them), and use a 170-Mbyte hard drive or a 1000-Mbyte one. Furthermore, so flexible a system makes it possible to alter a computer's characteristics over time. It is, for example, possible to expand the working memory, replace the hard drive by a more powerful one, or add a CD ROM unit. In addition, it is possible to order an IVK computer with even the most exotic required configuration, and machines so ordered will be assembled, tested, and shipped quickly. It should be noted that exotic orders are only rarely received and that the overwhelming majority of buyers can find the computer configuration they need on the list of turnkey IVK computers that are series produced at the Kvant plant. Included among them are more than 20 varieties of computers with a 386 processor, slightly more with a 486 processor, about 10 version with a Pentium processor, and slightly more notebook-class computers with a 486 processor. As an illustration, the table on page 4 of the color insert [text not provided] lists selected characteristics of IVK personal computers.

I would like to talk about one characteristic not included in the table, namely, the computer's price.

IVK computers cost about 10 percent more than computers of several Russian assembly firms whose main priority is price cutting and for whom relaiblity, quality, productivity, and compatibility with licensed software are secondary. Oftentimes, to achieve their main goal of price cutting, these firms buy poor-quality or obsolete components and they use them to assemble computers that do not, for all practical purposes, meet world standards and that are, to put it bluntly, filling the Russian computer market with rubbish.

The strategy of other well-known firms, such as Compaq, Dell, ALR, NEC, DEC, and HP among others is entirely different. These firms put the quality and relaiblity of their product first and value their prestige above all else. IVK has chosen the same strategy for itself; however, the cost of our machines is 15-20 percent lower than the respective analogues of the leading Western firms. There are several reasons for this. In particular, only individual components are imported into our country rather than than the finished products. The fact that IVK is not striving for an inflated rate of profit is also important.

And in conclusion, let me say something about service. Today the sale of computers without clear obligations regarding servicing them while they are under warranty and afterward is unthinkable. The wholesale factory price of most computers includes a 2-year warranty, and the warranty may be extended to 3 years if the customer wishes. IVK operates two service centers in Moscow, and there are already several dozen service centers attached to IVK dealers in all regions of Russian and in CIS countries. All subdepartments servicing IVK equipment are provided with the required list of repair kits and consumables for quick repairs no matter how complicated. Repairs are guaranteed to take no longer than 72 hours from the time equipment is brought into a service center. At the expiration of the warranty period, IVK offers customers a combined maintenance arrangement depending on their existing computer pool, the condition of their computers, and the amount of time for which they have been in use.

In partnership with a number of specialized firms, IVK provides big clients with the following services: personnel training, software installation, and computer network development. The fact that Sun Microsystems, a leading world authority on computer manufacture, has entrusted IVK with an exclusive contract to service its equipment in the CIS and Eastern Europe attests to IVK's level of service.

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IVK's computer project stands out among other IVK initiatives in that it is addressed toward a huge audience. The Kvant plant can produce a million computers ina-year. The computer project's success is tied not only to the solution of scientific, production, and financial problems but also to the formation of public opinion and the winning of buyers' and users' trust. There are already sure signs that users' trust in the IVK trademark is becoming a reality. And that is natural. IVK has done everything so that our computers' quality and reliability are in no way inferior to those of the more expensive and, for the time being, more prestigious personal computers produced by Western firms while having preserved the advantages of a machine made in your home and country. And IVK has done everything so that world-class domestically produced equipment would finally become the main player in our market not because of the buyer's patriotic feelings (or, to put it more accurately, not only because of patriotic feelings) but above all on the basis of objective indicators.

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Switching Waves and Autosolitons in Wide-Aperture Lasers With Saturating Absorption

957K0020A St. Petersburg OPTIKA I SPEKTROSKOPIYA in Russian Vol 77 No 2, Aug 94 (manuscript received 21 Jan 94) pp 308-312

[Article by N.N. Rozanov, State Institute of Optics imeni S.I. Vavilov, St. Petersburg; UDC 535.2]

[FBIS Abstract] The pattern of diffractional switching waves and auto-solitons in the field of a wide-aperture laser with a saturable absorbing medium along with the amplifying medium in the optical cavity is analyzed on the basis of the quasi-optical wave equation for a radiation field with slowly varying amplitude

$$\frac{\partial E}{\partial t} - i\frac{\partial^2 E}{\partial x^2} - \alpha(|E|^2)E = 0.$$

(t-time, x-transverse coordinate, E-field intensity, α-amplification excess over absorption). The coefficient α depends on the instantaneous magnitude of field $I = /E/^2$ in class A lasers and thus represents a inertialess nonlinearity. First is considered a simple theoretical model, one-dimensional emission in one of two transverse directions, this model being realizable in a planar laser scheme with single-mode emission in the other transverse direction. The field pattern of switching waves and autosolitons along with their coupled modes is generally of the

$$E = \exp(ivt)F(x - vt).$$

kind, where in this case

$$F'' - ivF' - [v + i\alpha(|F|^2)]F = 0.$$

form (F, F' denoting respectively first and second derivatives of F with respect to the space variable x - vt) and intensity I approaches either zero or a steady magnitude as $x - \xi t \to$. The analysis is simplified by linearization of this equation for F within the range of variable x - vt where the field intensity varies very little. Its solution describes the behavior of a switching wave or an autosoliton, such a description not being mathematically rigorous but physically plausible when compared with observations made in a passive nonlinear interferometer. The two aforementioned equations have already been shown to also apply to propagation of radiation pulses through the region of anomalous dispersion within a single-mode optical fiber with an almost periodic spacing of quickly saturable amplifying and absorbing elements. When a pulse of sufficiently long duration propagates through such a nonlinear optical fiber, a switching wave will therefore manifest itself as a widening or narrowing of the fiber region within switching of the pulse takes place and an autosoliton will appear with either phase or amplitude modulation of its intensity. It is this kind of autosoliton that an autosoliton obliquely propagating through the laser medium resembles. A ring laser scheme with perpetual propagation of an autosoliton thus evidently can also be realized in a fiber-optic version. The author thanks V.Ye. Semenov and S.V. Fedorov for helpful discussions. Figures 1; references 10.

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Modular High-Speed Fiber-Optic Transmission System

957K0008A Moscow ELEKTROSVYAZ in Russian No 6, Jun 94 (manuscript received 28 May 93, after revision Sep 93) pp 6-9

[Article by V. Ye. Golubkov, S. S. Karinskiy, M. N. Lur ye, M. Yu. Popkov; UDC 681.7.068]

[FBIS Translated Text] **Pre-requisites for the development of a fiber-optic transmission system.** Experience in creating information networks on district, city, and regional scales[1] has shown that it is expedient to use lines with high-speed fiber optic transmission systems 5-100 km long as the trunk communication lines for large information networks. For subscriber cabling, coaxial cables up to 5 km long may be used. The problem arose of developing a trunk fiber optic transmission system which provides simple connection to a subscriber network and the possibility of increasing the basic information parameters of high-speed fiber optic transmission line without making substantial changes in equipment.

Information is transmitted digitally along a trunk high-speed fiber-optic transmission system. This is because the existing opto-electronic elemental base limits the capability of analog transmission. Digital transmission is more universal, advanced, reliable, and stable, although it requires larger optical track bands to implement it. Moreover, one can simply retranslate signals without accumulating errors. The lines which carry signals from various sources of information can be multiplexed and the information parameters of a system for communication, processing, and storing of information can be increased.

A specialized high-speed digital fiber-optic transmission system was developed with a range of 0.1-1.0 km for mobile multi-node computing complexes. The main information stream between nodes of the complex for which the system was created consists of several dozen partial streams with a rate Q_1 = 12 Mbit/s and Q_2 = 2.4 Mbit/s. In one direction one must transmit up to 500 Mbit/s of information, and in the opposite direction, up to 100 Mbit/s. Eight channels (optical fibers) are used with a transmission speed in one channel of Q = 120 Mbit/s with a purely temporal separation of signals. Five channels are used for forward transmission, one reverse, and two are in "hot" reserve.[2]

This system structure made it possible to implement all the technical requirements. The digital part of the system uses inexpensive mass-produced microcircuits in the 100 series, which have a speed of 120 Mbit/s. Although this is close to the acceptable limit, it does not lead to complications in the development: in the opto-electronic part of the system previously developed semiconductor laser emitters (ILPN-206) and photodiodes (FD-112) were used at 1.3 μm. The optical track of the system was constructed with eight-wire cable (OLPG-50-7-5-8) framed with eight-band separable optical connectors specifically developed for this system.

There were substantial requirements on reliability. A modular construction principle was used in which each channel services its own group of functional modules (cells) and power supply subunits.

Selection of a Coding Method. Selection of a coding method is extremely important to obtain the maximum throughput in each channel of a digital fiber-optic transmission system with a low probability of error.[3]

At low transmission speeds, codes are used from class 1V2V, which have a great redundancy and high synchronizing properties. At intermediate transmission speeds, about 100 Mbit/s, block codes with intrasymbol correlation are used, for example, 5V6V, which has a good synchronizing capability with low redundancy. At high transmission speeds, 0.2-1.2 Gbit/s, codes with a small redundancy without zeroing are used, for example, 10V1S or 17V1R, which make it possible to make the most complete use of the speed of the system.

In codes without zeroing with a small redundancy, like NBIC, every N information samples of the scrambled stream are supplemented with an additional sample by inversion of the former. In NBIP codes another sample like an odd or even parity bit is added for a set of these samples. Our calculations showed that for these codes, when the length of the coding cycles were N+1=10-12 samples, the clock cycle separator should be a master generator, a common LC generator with a short-term frequency instability which does not exceed about 5×10^{-2}. The synchronizing capability of these codes remains completely acceptable, because the reduction in the sensitivity of the receiver due to this instability when these codes are used is a small value, 1.5-2 dB. An NBIP code makes it possible not only to implement qualitative synchronization, but also to effectively monitor the quality of transmission.

Considering the above, and the need for subsequent modernization of the fiber-optic transmission system to increase its throughput, an NBIP line code was selected.

In most fiber-optic transmission systems which use codes without zeroing, scrambling of the transmitted information and self-synchronizing descrambling is used. However, this is accompanied by a multiplication of errors due to the mutual correlation between samples of the scrambled signal. This fiber-optic transmission system uses a new scrambling method[4] which makes it possible to avoid many of the known drawbacks, in particular, the aforementioned. In this scrambling method, the total information digital stream, which is supplemented every N samples with odd parity bits, is added bit by bit modulo 2 with a pseudorandom sequence of analogous structure of length $M = 2^p - 1$ where $p3$ is a natural number. Each odd parity bit of the information signal is added modulo 2 with the corresponding even bit of the pseudorandom sequence

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in which, moreover, each KM^{th} even bit is inverted (that is, marked); K is a natural number.

This marking in the scrambled signal makes it possible to synchronize the pseudorandom sequence descrambling generator on the receiving side of the fiber optic transmission system, that is, supercyclic synchronization. Cyclic synchronization on the receiving side of the system is done with the odd parity bits of the scrambled signal, and the clock is synchronized by the switching times of the levels of the scrambled signal.

The following code parameters were selected for the formation of the NBIP scrambled code in the modular transmission system: cycle length $N + 1 = 10$, length of the pseudorandom sequence $M = 2^5 - 1 = 31$, length of the supercycle $(N + 1)KM = 12{,}400$. In the line signal of the system transmitting the information the following synchronization frequencies are coded: clock frequency $f = Q/1$ bit = 120 MHz, cycle frequency $f_{cyc} = f/(N + 1) = 12$ MHz and supercycle frequency $f_{scyc} = f_{cyc}/(KM) \approx 9.68$ kHz. The passband of the transmission line in this fiber optic transmission system may be very narrow in relation to the selected rate of information transmission in channel Q:

$$\Delta f = f/2 - \{0{,}05f[\pi(3N + 1)]\}^{-1} \approx f/2 = 60 \text{ МГц} \quad [2].$$

The noise resistance of this system may be very high because long sequences of zeros and ones are always limited when this system of coding is used.[2] The transmission method used in the fiber optic transmission system,[4] in addition to providing effective synchronization, effectively controls transmission errors.

Equipment and Basic Parameters of the Basic Fiber Optic Transmission System. Development of the system was completed in 1990. It was implemented with the described coding method and has successfully completed all types of testing.

In order to increase the technological level of manufacture, the operating characteristics and reliability of operation, the equipment was unified; tuning and non-mass-produced parts were eliminated. Automatic backup of channels was introduced, and automated devices were built in to monitor the probability of transmission error and faults in all nodes and units.

One channel of the system contains a timer, multiplexer, transmitter, optical fiber, receiver, and demultiplexer (Figure 1). The timer forms the required network of synchronization frequencies and the coding pseudorandom sequence for the selected method of transmission. The input information is multiplexed, then odd parity bits are added, and the resulting information signal is added modulo 2 with the psuedorandom sequence which has been formed. The coded signal is transmitted by opto-electronic transmitter through the optical fiber to the optoelectronic receiver. It detects the optical signal with a photodiode. The electric signal which is obtained is then amplified, compared, and decoded.

Decoding is done with a descrambler built into a decoder which contains a pseudorandom sequence generator and a circuit for forming even parity bits similar to the timers. The error detector monitors decoding errors and if there are errors, issues the "fail 1" signal. To normalize the reception of signals over time a 120 MHz VTCH [expansion not given] is used which is implemented in the form of a generator with phase auto-tuning of frequency in the phase detector and voltage regulation generator. To form the network of synchronization frequencies required on the receiving end of the system, the receiver has frequency splitters. If a large number of decoding errors appears, the signal "fail 1" is issued, which corrects the initial setting of the frequency splitters and descrambler. It also places the voltage regulation generator in frequency search mode, thus minimizing the frequency of decoding errors. The decoded signal is demultiplexed with simultaneous monitoring for transmission errors. The output information which is received is identical to the input information. It is then transmitted to the user.

A schematic of the entire eight-channel modular fiber optic transmission system is shown in Figure 2. The optical circuit of the system consists of a mass-produced field eight-wire fiber optic cable which is protected from rodents, two eight-band optical connectors, a group of mass-produced one-wire optical cables with cabling inside the cabinet and 16 mass-produced one-band optical connectors (List-Bulava).

The electric part of the system includes eight types of unified modules (cells): timer, multiplexer-demultiplexer, transmitter, receiver, device to monitor two types of cells, buffer amplifier, and device for interfacing with nonstandard signals. The functions of the basic cells are described above. The V2IPO79 cell is reversible and is used as a multiplexer and demultiplexer, which reduces the number of cell types.

The equipment is placed in two containers 1250x750x530 in size weighing 120 kg. Installed in the container is a typical four-section stand with a unified base support structure and subsystem of autonomous heat regulation. The stand contains 21 cells as well as control and electric power subunits.

Considering the redundancy of the line code and the maintenance of two channels in "hot" reserve, the maximum throughput of the system is 648 Mbit/s with a probability of error of no greater than 10^{-9}. At -50°C the peak power required is no greater than 3 kW, and entry into working mode requires no more than 1.2 kW. The

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average full operating time when the system is in continuous operation for 48 hours at a time is 3000 hours.

Calculations show that when the ILPN-206 laser emitters are replaced with the more modern ILPN-206-2 emitters, the reliability of the system may be increased by more than a factor of ten.

Ways of Improving the Parameters of the Fiber Optic Transmission System. Calculations show that the greatest effectiveness, from the point of view of thecomplexity-cost criterion, is achieved with a fiber optic transmission system in which the throughput of one channel is close to the total productivity level of all

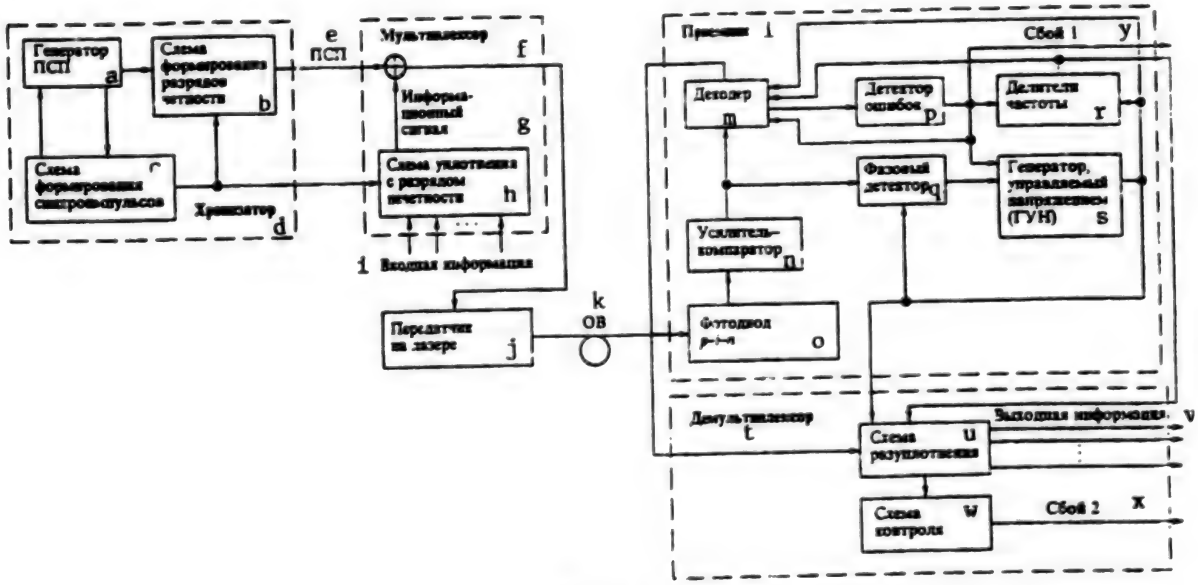

Figure 1.

Key: a. Pseudorandom Sequence Generator; b. Circuit To Form Even Parity Bits; c. Circuit To Form Synchronization Pulses; d. Timer; e. Pseudorandom Sequence; f. Multiplexer; g. Information Signal; h. Circuit for Multiplexing With Odd Bit; i. Input Information; j. Laser Transmitter; k. Optical Fiber; l. Receiver; m. Decoder; n. Amplifier-Comparer; o. p-i-n Diode; p. Error Detector; q. Phase Detector; r. Frequency Splitter; s. Voltage Regulation Generator; t. Demultiplexer; u. Demultiplexer Circuit; v. Output Information; w. Monitoring Circuit; x. Fail 2; y. Fail 1.

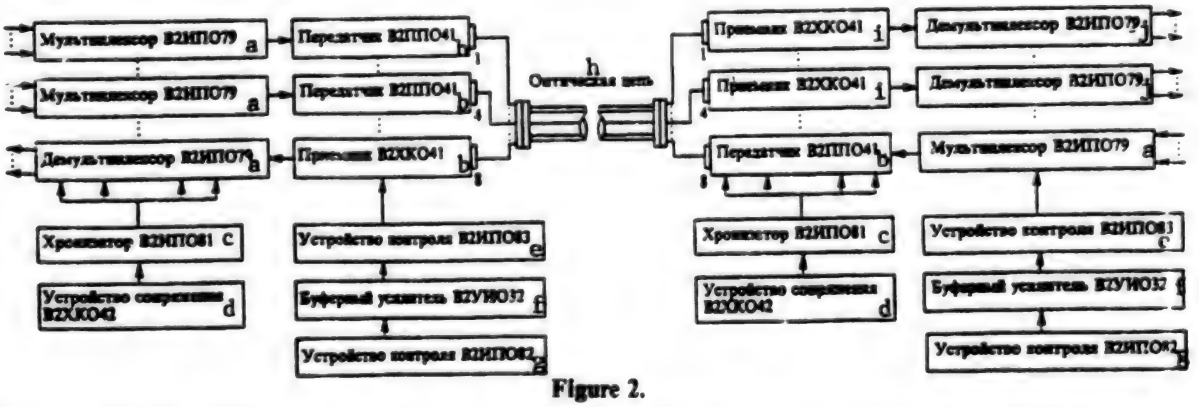

Figure 2.

Key: a. V2IPO79 Multiplexer; b. V2PPO41 Transmitter; c. V2IPO81 Timer; d. V2KhKO42 Interface Device; e. V2IPO83 Monitoring Device; f. V2UIO32 Buffer Amplifier; g. V2IPO82 Monitoring Device; h. Optical Circuit; i. V2KhKO41 Receiver; j. V2IPO79 Demultiplexer

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sources of information. Thus, to improve the characteristics of the system one must increase the line transmission speed along the fiber. However, a drastic improvement in the characteristics of a high-speed fiber optic transmission system can be obtained only when one can switch to a new, small, superfast analog and digital elemental base.

Russia is producing large integrated circuits with a speed and level of integration which is substantially higher than microcircuits in the 100 series, for example, semicustomized integrated circuits b ed on the V-100, I -300, and other base matrix chips. Analysis of the I-300B silicon base matrix chip showed that it should be used to replace the following functional digital units of the high-speed fiber optic transmission system: the upper levels of multiplexing and demultiplexing, basic synchronization frequency formers, psuedorandom sequence generators, coders, and decoders.

Analog and low-speed digital units of the system can be implemented in microcircuits with low and intermediate levels of integration. If possible, several low-speed digital units can be placed in one integrated circuit. The switch in the fast digital part of the system to I-300B base matrix chips increases speed, capabilities, and reliability, decreases power consumption, size, mass, and cost, and most important, reduces the number of producers of components.

In order to improve the fiber optic transmission system, integrated circuits have already been developed on the basis of the I-300B base matrix chip[4] with a speed of up to 650 Mbit/s. These microcircuits implement the final functional series of operations in the system, and operate as indicated above.[4]

Fiber Optic Transmission System for Television Signals. The fiber optic transmission system which has been developed has been supplemented with six types of newly developed modules (cells) [analog-to-digital converter of the video signal, ADC for the audio signal, DAC for the video signal, and DAC for the audio signal, multiplexer and demultiplexer of the low levels of multiplexing], and the creation of an experimental model of a digital fiber optic transmission system for television signals has been completed. It is called Telebit-1.

Figure 3 shows the external appearance of the fiber optic transmission system cabinet. The system is intended for high-quality transmission, reception, and retranslation of up to 12 television programs in the SEKAM or PAL standards, including stereo audio and housekeeping digital information. The cabinet consists of two eight-section stands with a unified base support structure. It will be installed at nodes of the cable television network system. One program can be transmitted with Telebit-1 at a speed of about 140 Mbit/s.

The schematic of one channel of Telebit-1 is shown in Figure 4. The total video signal is digitized with an ADC with a quantization frequency of F_t = 13.5 MHz and

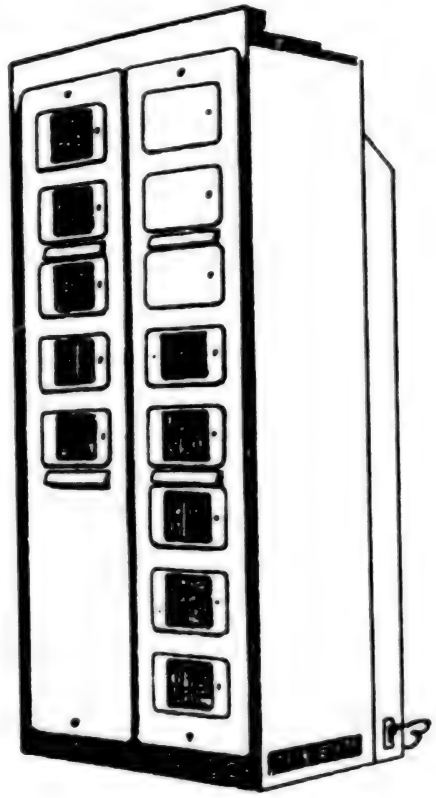

Figure 3.

eight bit accuracy. Two 14-bit ADCs with quantization frequency F_s = 48 kHz are used for the stereo signals. The reverse digital to analog operations are done with DACs with interfaced parameters. The rate of transmission of digital information along a gradient optical fiber is 135-140 Mbit/s with a range of up to 10 km.

The table gives the basic parameters of the basic fiber optic transmission system, as well as Telebit-1 and Telebit-4(5) for television and housekeeping information in the VGTRK cable television network.

Table

Name of Basic Characteristics	Basic Fiber Optic Transmission System	Telebit-1	Telebit-4(5)
Communication Organization	Duplex	Duplex	Simplex
Number of Physical Channels	8	12	1
Throughput, Mbit/s	120x8=960	135x12=1620	486(486)

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Transmitted Information:			
Data Transmission (DT)	DT (12 Mbit/s), control commands	10 TV	4TV (5TV)
Video Channel (TV)		12A	16 (20)A
Audio channel (A)		4DT	4DT
		(2048 Mbit/s)	(2048 Mbit/s)
Channel Code	NRZ,10VR1	NRZ, 10VR1	NRZ, 12VR1
Wavelength, μm	1.3	1.3	1.3
Type of Lightguide	Multimode	Multimode, Single Mode	Single Mode
Transmission Distance, km	0.1-5.0	10(30)	30-50
Number of Lightguides	8	16	1
Power Per Channel, W	125	100	150

Telebit-4(5) uses a VLSI circuit with an I-300B base matrix chip (microcircuit 1520.KhM3-04.160/446) in the digital part of the equipment.[5]

Testing of the fiber optic transmission system showed that the sensitivity of the system was 0.8 μW, and the average optical strength input to the lightguide was about 300 μW at $P_f = 10^{-9}$ (Ref. 6).

Conclusion. The method proposed by the authors for the transmission of information in a digital fiber optic transmission system was used to develop (part of the system is in the development stage) a number of modular high-speed fiber-optic transmission systems for electronic-computing complexes and one- or multi-program television broadcasting.

The high throughput of these fiber optic transmission systems creates the pre-conditions for uniting all private networks (cable television, local computing networks, etc.) into one general-purpose integrated information network.

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Draft Federal Law on Communications Explained

957K0018A Moscow VESTNIK SVYAZI in Russian No 8, Aug 94 pp 7-8

[Article by Yu. A. Tolmachev, deputy chairman, State Committee on Telecommunications; the first two paragraphs are an introduction]

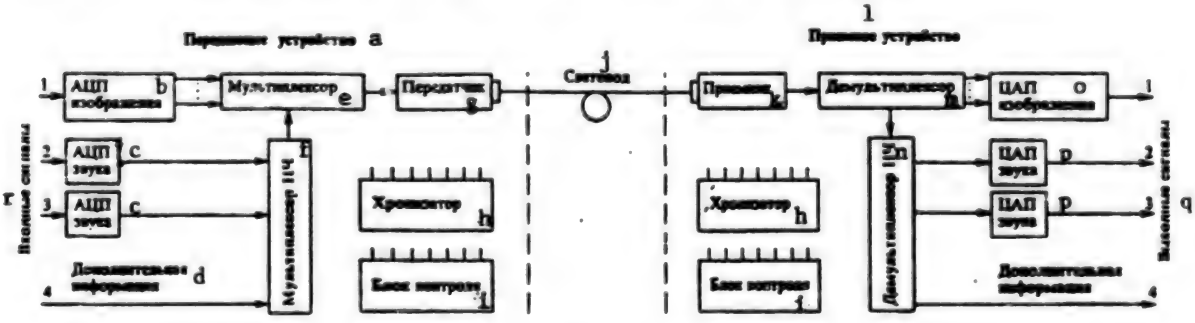

Figure 4.

Key: a. Transmitting Device; b. Image ADC; c. Sound ADC; d. Additional Information; e. Multiplexer; f. Low-Frequency Multiplexer; g. Transmitter; h. Timer; i. Monitoring Unit; j. Lightguide; k. Receiver; l. Receiving Device; m. Demultiplexer; n. Low-Frequency Demultiplexer; o. Image DAC; p. Sound DAC; q. Output Signals; r. Input Signals.

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[FBIS Translated Text] At the Parliamentary Center of the Russian Federation on 30 June there were public hearings on the draft of the Federal Law of the Russian Federation on Communications with the participation of members of the Committee on Information Policy and Communication of the State Duma of the Federal Assembly of the Russian Federation, the directors of the Ministry, communication enterprises and organizations, international experts, representatives of scientific organizations in the field of state law and economics, television-radio companies, joint enterprises, commercial organizations, foreign companies and the community at large. The draft law for the most part was approved by those assembled and was sent on to the Committee on Information Policy and Communication which discussed it on 12 July and sent it on to the State Duma Council. On 14 July the State Duma Council discussed the draft laws on communications and state messenger services and forwarded them in accordance with established procedures for the comments of the committees of the State Duma and the RF Government.

Below we publish the address of Yu. A. Tolmachev, deputy chairman of the State Committee on Telecommunications, at the public hearings on the draft law on communications.

In this auditorium it is superfluous to mention that a reliable and well-developed communication system is the material basis for control of the state and economy, a highly important factor in defense capability and safety of the country. Providing a technical base for the work involved in collection, processing, storage and dissemination of information, communications facilitate the development of culture and education, movement of capital, goods and services in the interests of users.

Under conditions of change in the geopolitical situation of the Russian Federation, the deep economic reform in progress and changeover to a market economy, legislation in the communications field is acquiring a special significance. This legislation must reflect the strategic goals for its development and improvement applicable to the requirements of both the present time and a definite time in the future.

The demonopolization and privatization of organizational-production structures in the communications branch, carried out on a broad scale, also are contingent on the existence of clear legislative regulation of the functioning and development of national communications.

It must be noted that the existence of national communications legislation is a highly important factor providing a guarantee of the responsibility of the state and its executive agencies for meeting its obligations to the world community.

The organizational structure of the agencies managing the branch, as provided for in the draft of the Federal Law, corresponds to the Constitution of the Russian Federation and legislative acts adopted during recent years in the field of governmental structuring of the country and affords broad possibilities for demonopolization in the branch, support of new economic structures, development of competition and attraction of investors under different forms of ownership for accelerating the development and improvement of electric and mail communication services on the basis of modern technologies and their integration into world communication networks.

In general the draft of the Federal Law provides the juridical premises for an increase in the national communications network which outpaces other spheres of social production, which is usually the case for highly developed countries and is directly dependent on the gross national product.

The Federal Law is intended to define the principles of legislative authority for activity in the branch, which after 1917 was regulated solely by a body of regulations, the last of which was approved by Resolution No 316 of the USSR Council of Ministers dated 27 May 1971 and supplemented in 1978. Urgent measures for legislation in the communications field as formulated by the government were accepted by the president of the Russian Federation and affirmed by his decree No 810 dated 31 July 1992 entitled "Interim Regulations on Communications in the Russian Federation," in effect up to adoption of the Federal Law on Communications.

The presented draft of the Federal Law is the result of four years of work by a highly qualified body of communication specialists, scientific organizations in the field of state law and economics, teams of international experts and a wide community of national communication specialists. As presented by the RF government the draft was forwarded by the President of the Russian Federation as No PR-58 to the RF Supreme Soviet with the recommendation that it be adopted as the basis for further elaboration. By a decree of the Presidium of the RF Supreme Soviet dated 12 April 1993 the draft law was sent for comments to various entities of the federation and to the standing commissions and committees of the Supreme Soviet and then was finalized with allowance for the comments made, for the most part supporting the draft and the Constitution of the Russian Federation adopted in December 1993.

In addition, the draft takes into account adopted legislative acts on enterprises and entrepreneurial activity, competition and restriction of monopolistic activity in the commercial markets, on investments, privatization, consumer protection and other acts meant to ensure the economic, sociopolitical and spiritual regeneration of Russia.

The draft provides for:

- equal rights of juridical entities and individuals to participation in communications activity and the use of its results;

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- freedom to transmit communications via telecommunication networks and equipment, as well as by postal facilities, and mail transit in the entire territory of the Russian Federation;
- an increase in the quality, reliability and broadening of the range of afforded communication services;
- protection of the rights of users of communication services;
- introduction of world attainments in the communications field, including
- advanced foreign equipment and management experience;
- assurance of priority in the production of communication equipment in the Russian Federation in accordance with national scientific-technical policy.

It is assumed that this draft law will become the first stage in preparation of a package of laws regulating activity of the branch in different spheres (postal and state messenger services, radio frequency spectrum, radio-TV broadcasting, means of mass information, administrative breakdowns in the communications field and others). Accordingly, an objective of the proposed draft of the federal law also is establishing the basis and possibilities for subsequent legislation.

The basis for the concept of the federal law is the principle of responsibility of the Russian Federation government and the agencies of executive authority to communication users for communication network condition in the country and also the further development and improvement of communications for the purpose of meeting the needs of the agencies of executive authority, defense, safety, safeguarding of law and order, the population, economic structures and other juridical entities and individuals for electric and postal communication services.

Under the new conditions the Russian Ministry of Communications, with a threefold reduction in personnel from 1990 to the present time (from 1200 to 400 persons) and a completely modified structure, is becoming the agency of state regulation of communications in the country, freed of economic activity, with newly defined functions, such as interbranch regulation on a collegial basis, licensing of activity for the affording of communication services, certification of communication equipment, organizing and ensuring state technical supervision of the activity of communication enterprises regardless of departmental affiliation and forms of ownership.

In addition to assignment to the RF Ministry of Communications the rights of state regulation of electric and postal communication in the country, provision also is made for its freeing from economic functions, separation of the national postal service, requiring support from the state budget, into an independent branch, structuring of TV and radio enterprises on the basis of federal ownership and transformation of telecommunication enterprises to joint-stock companies (with the controlling block of shares in federal ownership).

Responsibility is retained for policy in the communications field and in necessary cases there is assurance of centralized control of the national communications network for the government of the Russian Federation and the agencies of executive authority, as corresponds to the position of Russia as a nuclear power controlling strategic nuclear forces via the national communication networks, regardless of to whom these networks may belong.

Important measures for protecting the rights of consumers by setting of strict qualitative indices for the afforded communication services will be ensured by establishing a normative base, setting up of an institute for the certification of communications equipment and assignment of appropriate powers to the State Communications Oversight Office. Provision also is made for the right of consumers to protect their interests at all judicial levels.

The draft law provides for a combination of the interests of the Russian Federation and entities of the federation in the communications field, assigning the latter the necessary rights and powers.

The regularization and truly economical use of the principal resources of electric and postal communication services provided for in the draft law and also extensive attraction of foreign investments in the development and improvement of communication networks will yield an unconditional economic benefit.

With introduction of the law:

- the treasury will receive new sources of foreign exchange income by the taxation of foreign investments and subsequent activity of communication enterprises with foreign capital;
- there will be privatization of telecommunications enterprises and the introduction of free tariffs for communication services will increase the efficiency of their operation and will make it possible to augment budget receipts;
- permission will be given for commercial activity for the affording of communication services to enterprises of departmental communication networks, including the communication networks of the energy ministries, and this will become an additional source of income to the budget by roughly 10% of the total sums of budget payments;
- a considerable sector of commercial (private) communication networks will be formed and accordingly there will be an increase in tax receipts in the budget.

In evaluating the sources of economic efficiency the draft law takes into account that communications is a diversified branch and is made up not only of the general-use communications network, including 330 communications enterprises managed by the RF Ministry of Communications, but also 186 enterprises having a departmental affiliation (for the most part servicing the fuel-energy complex and transportation) and more than 600

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enterprises established on the basis of joint and private capital which have been organized during recent years and which constitute a medium competing with traditional communication enterprises.

Today there are 824,500 employees in enterprises of the general-use communication network, and at the remaining enterprises about 150,000. In the general-use network there are 26.0 million telephones, including 17 million among the general population. The extent of the interurban telephone network is more than 308 million ch-km, including 20 million in departmental communication networks.

The telephone density per 100 inhabitants is 20.7 in the city and 9.8 instruments in the countryside. An analysis of the load in the communications network indicates that on the average each inhabitant of our country uses communication services 5 times per day.

Among the general-use communication enterprises there are 100 television, radio broadcasting and radiofication enterprises and 87 postal communication enterprises.

As of 25 June 1994 of the 100 general-use telecommunications network enterprises 90 of these enterprises have been transformed into joint-stock companies; the others are in the finalization stage.

For the affording of communication services as of 1 June 1994 a total of 1,101 licenses had been issued, including 633 for telecommunications, 440 for television and radiobroadcasting and 28 for postal communication.

In general communications as a productive-economic complex is profitable for the state. The introduction of the new law does not provide for and does not require an increase for the branch with respect to the traditional budget appropriations directed to the maintenance of the postal, including official messenger communication services, mobilization preparation of the communications network and setting up of a reserve of communication equipment and cable products, other than sums for the construction of communication structures under adopted government programs (development of the Rossiya satellite communication and broadcasting system, development of E-mail and postal communication, Selo radio and television in rural areas, etc.).

The adoption of this draft law in the coming decade will provide conditions for the optimum combination of the interests of the state and users in the communications field, will make it possible to reconstruct the national communications network on the basis of modern technologies with a doubling or tripling of its capacity and the scope of afforded services and will solve the social objectives of protection of the population, for these purposes using 0.6-0.8% of the annual gross national product.

Concept for Using Communications Switching Equipment in Interlinked Communication Network of Russia During Period 1994-2000

957K0018B Moscow VESTNIK SVYAZI in Russian No 10, Oct 94 pp 11-13

[Unsigned; the first paragraph is an introduction]

[FBIS Translated Text] This concept was worked out in accordance with the "Concept of a Program for Development of the Russian Federation in the Communications Field to the Year 2010," approved by the Russian Government on 25 March 1993 (Protocol No 11) and directed to an increasing of efficiency in use of switching equipment for telephone communication networks in the Russian Interlinked Communication Network (ILCN) during the period 1994-2000[1]. The concept is being extended to all telephone communication networks making up the Russian ILCN (regardless of the forms of ownership and departmental affiliation) and to switching equipment intended for use in these networks.

Purpose of Concept:

Definition of the policy of the RF Ministry of Communications on use of switching equipment in the Russian ILCN under the new economic conditions during the period 1994-2000;

definition of the principles for cooperation with the suppliers of switching equipment for the Russian ILCN.

The provisions of this concept cover switching equipment (including both hardware and software) developed and produced by national industry, manufactured under foreign licenses or purchased abroad.

They must be taken into account when working out projects for use of switching equipment and organization of its operation in the Russian Interlinked Communication Network (ILCN).

The concept can be made more precise and supplemented with allowance for experience in implementing its provisions in the Russian ILCN.

Current Status of Switching Equipment

As of 1 June 1994 the following are in operation in Russian territory:

- five international telephone offices (ITO) of the quasi-electronic and electronic types;
- five automatic switching pads (UAC) of the quasi-electronic and electronic types;
- 100 automatic interurban telephone offices (AIUO) [toll offices], including those of the ten-step type—17%, coordinate [crossbar] type—62%, quasi-electronic type—16%, electronic type—5%.

Less than half these offices meet ILCN requirements.

The capacity of the urban telephone networks is 19,676 million numbers, for which 61.9% of the switching

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equipment is of the coordinate type, 28% is of the ten-step type and only 10.1% is of the digital type.

The capacity of the rural telephone networks is 3,928 million numbers, for which 94.9% of the switching equipment is of the coordinate type, 0.75% is of the ten-step type and only 4.3% is of the digital type.

In accordance with the "Concept of the Program for Development of the Russian Federation in the Communications Field to the Year 2010" the need for switching equipment for the Russian ILCN to the year 2000 will be: UAC—9, ITO—10, AIUO—128, city automated central offices (CACO) [city telephone exchanges]—total capacity of 33.6 million numbers, rural telephone offices—total capacity of 4.38 million numbers.

There is a need for small dial PBXs cut into subscriber lines (industrial-commercial-institutional offices).

As of 1 June 1994 the following foreign-produced switching equipment had been certified for use in the Russian ILCN:

ITO of the AXE-10 type, Nikola Tesla Plant (Croatia),

AIUO and CACO of the AXE-10 type, Nikola Tesla Plant (Croatia), Ericsson Plant (Sweden),

AIUO and CACO of the S-12 type, Alcatel Bell Company (Belgium),

AIUO and CACO of the EWSD type, Siemens Company (Germany), Iskra Tel (Slovenia),

CACO of the SI-2000 type, Iskra Tel (Slovenia),

CACO of the TDX-IB type, Samsung Company (South Korea), CACO of Linea UT type, Italtel Company (Italy), CACO of the SESS type, AT&T (United States),

CACO of System X type, GPT Company (Great Britain),

CACO of Starex-TX type, Goldstar Company (South Korea).

A full list of switching equipment for urban, rural and industrial- commercial-institutional networks is given in the "List of Communication Equipment Certified by the RF Ministry of Communications")[2].

At the present time development work is proceeding in Russia and the following digital switching equipment is being introduced:

- city ATO of the MT-20 type (BETO enterprise);
- city ATO of the ATSTs-90 type (Leningrad Branch, Scientific Research Institute of Communications, Telecommunications Equipment Scientific Research Institute, Krasnaya Zarya plant);
- rural ATO of the ATSTs-90 type (SOKOL joint-stock company);
- city ATO of EATS-TsA type (Central Scientific Research Institute of Communications, DME, Dnepropetrovsk);
- city, rural and industrial- commercial-institutional ATO (ICI ATO) of Fobos-TF type (Krasnaya zarya Scientific Production Enterprise);
- ICI ATO and rural ATO of the Beta-II type (Telecommunications Equipment Scientific Research Institute and VT joint-stock company, Minsk);
- ICI ATO and rural ATO of Sigma type (Progress joint-stock company).

ICI ATO and rural ATO of Kvants-Ts type (VT joint-stock company, Minsk, Romny). National industry in the next few years will be unable to ensure delivery of the necessary amount of modern switching equipment to the network.

The joint enterprises established in Russia for the production of equipment of the S-12, EWSD, Linea UT and TDX types have not yet started up switching equipment production.

In this connection in Russian interurban and international telephone networks plans for the period 1994-2000 call for constructing foreign- produced digital offices and putting them into operation. In city networks plans call for the use of both national and imported offices. Plans provide for predominantly nationally produced offices to be used in rural networks.

Fundamental Provisions in Policy of RF Ministry of Communications on Use of Switching Equipment

The RF Ministry of Communications defines the technical policy for the development of communications in the Russian Federation, the list of types of communication equipment and systems allowable for operation in international, interurban and local communication networks making up the Russian ILCN.

The fundamental principles for use of switching equipment are:

All types of switching equipment intended for use in the Russian ILCN must have a certificate of compliance[3].

With the modification of switching equipment, including its software, it must undergo additional certification.

In the ILCN the number of types of foreign-manufactured switching equipment is restricted.

The following types of switching equipment are allowed for use: in international networks—AXE-10 and EWSD;

in interurban networks—AXE-10, EWSD and S-12;

in local networks—not more than two types of foreign-produced ATO for one region.

The list of types of foreign-manufactured switching equipment for specific regions is set by the RF Ministry of Communications.

The use of switching equipment manufactured in our country or produced in Russia under foreign licenses is not restricted.

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The use of combined offices is allowed under the condition of adherence to the requirements set forth in Section 2, 1. 2. By "combined offices" is meant offices used simultaneously in several networks, such as international and interurban.

The possibility of using switching equipment in a modular variant is admissible in local networks.

The use of switching equipment in a modular variant is recommended for organizing communications in exceptional situations.

In exceptional cases the use of AIUO in a modular variant is admissible.

It is admissible to make use of small dial PBXs connected to subscriber lines (industrial-commercial-institutional offices).

Switching equipment must satisfy the requirements on the safety system and the technical operation requirements for compliance with routine oversight measures in telecommunication networks in accordance with the law "Routine Oversight Activity in the Russian Federation."

Russian specialized organizations must be involved to the greatest degree possible in the designing and construction of telephone offices.

The main design institutes for the designing of switching equipment are:

Giprosvyaz—for interurban telephone networks;
Giprosvyaz-2—for local telephone networks.

The main design institutes are working out methodological guidelines for design work and on a contract basis are disseminating the necessary initial data for the designing of switching equipment in ILCN communication networks.

Projects for using switching equipment in the Russian ILCN must undergo state expert evaluation under established procedures.

It is admissible that there be joint use of switching equipment by different operators of ILCN communication networks under the condition that each of them adheres to licensing requirements.

It is admissible that there be joint use of switching equipment by operators of ILCN communication networks and detached communication networks under the condition that each of them adheres to licensing requirements.

With the joint use of switching equipment it is mandatory for communication network operators that there be adherence to the provisions of this concept.

The relationships among communication network operators when using switching equipment must be organized on a contractual basis with allowance for the necessary expenditures on proportional development, reconstruction of networks, etc.

With the interconnection of communication networks to the general-use communication network it is necessary to be guided by the provisions of this concept, also including with respect to the types of foreign- produced switching equipment for use in a particular region.

Fundamental Principles for Choice of Switching Equipment for Use in Russian ILCN

Each customer when selecting specific equipment must see to it:

- that it is possible to increase office capacity for a sufficiently long time (not less than 10 years);
- that the OKS (optic-fiber system) No 7 signaling system is used;
- that there is equipment for operation in the synchronization network;
- that there is a possibility for introducing new services for network users, including ISDN services;
- that there is a possibility for using new software versions;
- that there is a possibility for organizing dynamic control of load flows in the network;
- that there is a possibility for interconnection with land mobile radio communication networks;
- that there is electric supply equipment;
- that there is mechanical voice equipment;
- that there is equipment for centralized record keeping of the cost of conversations and computation systems;
- that there is test equipment;
- that there are digital and analog intermediate distribution frames;
- that the need is met for delivery of installation materials and connecting cables;
- that there is operational and technical servicing equipment; analog-to- digital converters;
- that there is availability of transmission measuring sets;
- that specialists are trained.

It is recommended that switching equipment be purchased on a competitive basis.

All other conditions being equal, it is recommended that national equipment or its individual components (distributing frames, transmission systems, telecommunications equipment, etc.) be purchased.

When choosing a supplier of foreign-manufactured switching equipment preference is given to companies organizing the manufacture of such equipment in the territory of the Russian Federation.

Fundamental Principles for Interaction With Suppliers of Switching Equipment for Russian ILCN

When delivering switching equipment, the suppliers, by agreement with the RF Ministry of Communications, must organize one or more regional centers for the

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warranty and post-warranty servicing and repair of the supplied equipment, and in case of necessity, software; technical servicing centers; centers for the training of specialists. The procedures for interaction between suppliers of switching equipment and the Ministry of Communications are defined in an appropriate Memorandum.

Suppliers of switching equipment must make provision for delivery of the know-how for the software under procedures defined by the RF Ministry of Communications.

Suppliers of switching equipment must supply the latest variants of equipment and software versions.

Suppliers of switching equipment manufactured in our country must be afforded state protectionist support.

In case of necessity it is possible to introduce measures for restricting deliveries of individual types of foreign switching equipment to the Russian ILCN.

Footnotes

1. Matters relating to the use of switching equipment for other communication networks are examined in pertinent sections of the "Principal Regulations on Development of the RF Interlinked Communications Network," code "Fakel-2."

2. The "List of Communications Equipment Certified by the RF Ministry of Communications" is published quarterly by the Informsvyaz Scientific- Technical Information Center.

3. A certificate of compliance is a document issued by the RF Ministry of Communications confirming that the switching equipment corresponds to ILCN requirements.

Memorandum on Mutual Understanding and Fundamental Principles of Cooperation in Development of Communication Networks and Equipment in Territory of Russian Federation

957K0019A Moscow VESTNIK SVYAZI in Russian No 10 Oct 94 p 4

[Article by A. Ye. Krupnov, RF First Deputy Minister of Communications]

[FBIS Translated Text] During the last several years there has been a sharp increase in the activity of different foreign companies manufacturing communications equipment and foreign operators in the international communications field in the Russian communications equipment market. Among these there are both our long-time traditional partners, cooperation with which has stood the test of time, and new, in many cases little-known firms and companies.

Under conditions of the government withdrawal from a large number of telecommunications enterprises, liberalization of seller-buyer relations and a virtual absence of centralized funding for purchases of imported equipment a rather great many precedents have occurred when communications equipment for regions is purchased by decision of local, oblast and city administrations (they pay the money), which virtually force local communication specialists to take the equipment from the firms selected by these administrations, frequently randomly.

As a result a great many types of equipment are appearing which do not fit into the communications network of Russia and which do not enable a particular region to develop communications in accordance with the general plan for long-range development of the interlinked network.

Such a situation can no longer continue and the RF Ministry of Communications as the body responsible for the condition and coordinated development of communications in the country has adopted a number of directive documents, regulating rules and conditions for the deliveries of equipment to the Russian communications network.

One of the most recent documents relating to this problem is the "Memorandum on Mutual Understanding and Fundamental Principles of Cooperation in Development of Communication Networks and Equipment in the Territory of the Russian Federation," drawn up by Ministry specialists.

This document regulates the conditions which must be met by the supplying company (incidentally, also any Russian company) if it wants to receive assistance from communication agencies in deliveries of its equipment to the Russian market.

The most important of these conditions are:

- holding of a certificate from the RF Ministry of Communications authorizing use of a specific type of equipment produced by a company in the Russian communications network;
- the company (and its communication partners) must bear in mind that the coordination of all work with the participation of companies, enterprises and any juridical entities in work on improvement and further development of communication networks, facilities and services in the territory of Russia is the responsibility of the Russian Ministry of Communications;
- The RF Ministry of Communications defines technical policy on the development of communications in Russia, the range of types of communication equipment and systems admissible for operation in communication networks at all levels, including departmental, if they interact with Russian federal communication networks;
- the choice of a specific supplier of equipment for a given communications facility is usually made on a

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competitive basis. Contracts for delivery of equipment for general-use federal communications networks are concluded only after agreement with the RF Ministry of Communications;

- all other conditions being equal, in choosing the supplier of foreign- produced equipment the preference is given to companies organizing the production of such equipment in the territory of the Russian Federation;
- the suppliers of equipment in the case of a considerable volume of purchases organize in the territory of Russia technical centers for the warranty and post-warranty servicing of the equipment supplied by them, for the modification and generation of software and for providing the know-how for the new technologies for the functioning of communications equipment, as well as for the training of Russian specialists.

With the satisfaction of these and other provisions of the Memorandum the supplying company and the RF Ministry of Communications ensure an effective participation of this company in the Russian telecommunications market.

The Memorandum is open for signature by supplying companies and by the Ministry. But this does not mean that the Ministry will sign this document with any company desiring to sell us their communications equipment or services.

First of all we will sign it (with all the concomitant reciprocal obligations) with our long-standing, established, already "tried and true" partners. For example, the Memorandum has been signed by such companies as Siemens and Alkatel Sel (Germany), the Russian company Ericsson Corporation, Samsung (South Korea), Italtel (Italy) and others.

In order to obtain the right to sign the Memorandum the supplying company must demonstrate the seriousness of its intentions (and capabilities) to participate in the development of the Russian communications network. And we will render every kind of assistance to such companies.

This does not mean that the road to our market is blocked for other companies. Let them work, compete, demonstrate the seriousness and effectiveness of their intentions and we will accept them among our permanent partners.

Synchronization of Digital Networks

957K0019B Moscow VESTNIK SVYAZI in Russian No 10 Oct 94 p 8

[Resolutions of Scientific-Technical Council, RF Ministry of Communications]

[FBIS Translated Text] The engineering development project "Plan for Organizing Synchronization of Digital Networks in the Russian Federation," prepared by a team of scientific specialists at the Central Scientific Research Institute of Communications (TsNIIS) with the collaboration of Giprosvyaz specialists, was examined at the sixth session of the Scientific-Technical Council of the RF Ministry of Communications. A report was presented by Yu. A. Alekseyev, deputy general director of the TsNIIS.

The normal functioning of digital networks requires its own synchronization system—so-called cyclic network synchronization (TSS). With its use it is possible to prevent losses or the repetition ("slippage") of information at points of interconnection of digital transmission and switching systems. The principal points in TSS construction are as follows.

First the TSS system must be unified for all Russian digital networks, organized on the hierarchical principle of hand-down of synchronization "from leading to led" with a preselected priority. Network synchronization must be accomplished from the top down—from the automatic switching pads (UAC) (or international telephone offices (ITO)) to interurban telephone offices (IUTO) [toll offices] and then to the switching stations of local networks.

The network with the TSS system is superposed on the Russian digital interlinked communication network (ILCN) and is developing together with it.

The territory of Russia in which the digital network is laid out is divided into eight regions, within each of which the equipment to be synchronized must operate synchronously. Alternating operation among regions is admissible.

A primary standard generator, in its parameters corresponding to the recommendations of the ICCTT (International Telegraph and Telephone Consultative Committee), is installed in each region in the UAC, reference optical transmission network or ITO. Precisely it serves as the synchronization source for all regional switching stations and synchronous relay systems. As such a generator it is recommended that use be made of the designated synchronization apparatus conforming to ICCTT recommendation G0811. The Dalnyaya svyaz Scientific Production Enterprise is completing development work on this apparatus.

As the synchronizing signal for the "leading" switching stations it is necessary to use a cyclic frequency signal discriminated from the selected inflow of the digital group 2048 kbit/s or registered at the output of a synchronous relay system.

In discussing the engineering development project "Plan for Organizing Synchronization of Digital Networks in the Russian Federation" the scientific-technical council as a basis adopted the "Fundamental Principles for Constructing and Recommendations on Putting Into Operation a Synchronization System at All Levels of the Digital Network in the Russian Federation," developed

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by the TsNIIS, as well as the plan for organizing synchronization in the first stage up to 1995 with working out of specific projects for the development of digital networks.

It is recommended that the special features of TSS operation be taken into account in the certification of switching equipment and relay systems by the certification and telecommunications sections of the Ministry of Communications, certification centers and laboratories.

It is proposed that the telecommunications section, in its plans for research, development, testing and engineering, develop two technical working models—for organizing TSS systems for the general-use network and the private network (departmental, commercial), and also for organizing synchronization services in specific network structures. In the working models it is necessary to take into account the priority needs of the network associated with its synchronization when constructing 35 electronic AIUO during 1994-1995.

In the expert evaluation of the design documentation for digital ATO, AIUO and ITO and when they are put on line the state enterprise Svyazekspertiz (Communication Expert Evaluation Enterprise) and the agencies of Gossvyaznadzor (State Communications Oversight Office) should direct attention to the existence of projects for linking stations in the TSS system and their practical operation.

When working on the second edition of the "Principal Points in Development of the Russian ILCN During the Period to the Year 2005" it is recommended that the TsNIIS take into account the results of the synchronization work considered by the scientific-technical council.

Ad Describes Suburban Moscow Cellular Telephone Network

957K0019C Moscow VESTNIK SVYAZI in Russian No 10 Oct 94 p 2

[Unsigned advertisement]

[FBIS Translated Text] Cellular radio telephone communication is enjoying an ever-increasing demand in the Russian communication services market. Among the areas of its vigorous development a special place is occupied by the Moscow region. And this is understandable. In the capital, which accounts for 76% of all business activity in the country, there are many rich people, and they prefer to live in the Moscow region "Green Ring" of dacha settlements with which all communication facilities have grown together with Moscow and together with it has formed one of the world's largest megapolises. According to the most modest calculations, even after two or three years the number of cellular phone communication clients in the close-in Moscow region may attain 60,000. This means that the developing competitive struggle for the Moscow region communications market, whose echoes were splashed on the pages of the September press, will acquire an increasingly more bitter character. The prize for the winner is the highest income from a cellular phone business in the country and, of course, it is a project of the greatest technical interest. One of its "competitors" is Regionalnaya sotovaya svyaz (Regional Cellular Phone Communications Enterprise). It was established in 1993 with the participation of the state communication and information enterprise Rossvyazinform in Moscow Oblast, which has a license for cellular phone communication meeting the American AMPS standard. The license prescribes: the system in Moscow and in the Moscow region must be technically unified and therefore it is necessary to establish an integrated enterprise with the joint-stock company VympelKom, the owner of the urban network. Such an enterprise—Obyedinennaya sotovaya svyaz (Joint Cellular Phone Network)—has been organized. It is assumed that it will coordinate the activity of the two operators, define the strategic directions of development, solve problems involved in the training of specialists and provide centralized deliveries of equipment. The Regional Cellular Phone Communications Enterprise is entrusted construction of a cellular phone "necklace" around the capital and further development of the oblast cellular phone network. The equipment for it will be supplied by the American company AT&T—the largest producer of telecommunication equipment in the world. Prior to the end of 1994 plans call for establishing nine base stations around Moscow and then it will be possible to use a cellular telephone on any of the radial highways at a distance up to 50-60 km from Moscow. By June 1995 the system will become analog-digital, and later completely digital, which will increase both its capacity and the quality of its services. But the city cellular phone network plans are not limited to construction of the ring. During the course of all of 1995 the network will be developed along the most important routes in the oblast and in such cities in the Moscow region as Chekhov, Obninsk and Kolomna and before July 1996 local cellular phone systems will be established with access to the telephone networks of these cities. In that case the subscribers of the oblast network also will be able to use their cellular telephones in Moscow. In contrast to Moskovaya sotovaya svyaz and the Bi layn network (VympelKom), the regional cellular phone system is oriented both on clients requiring mobile telephone communication and clients who have constructed or intend to construct themselves a home within the range 100-130 km from the ring and want to ensure constant communication with their residence. For this purpose it is sufficient to acquire a cellular telephone, install a special rooftop antenna and communication is ready. If a group of homeowners wants to become a collective client it is possible to set up a local concentrator. A system of rebates would apply to such clients.

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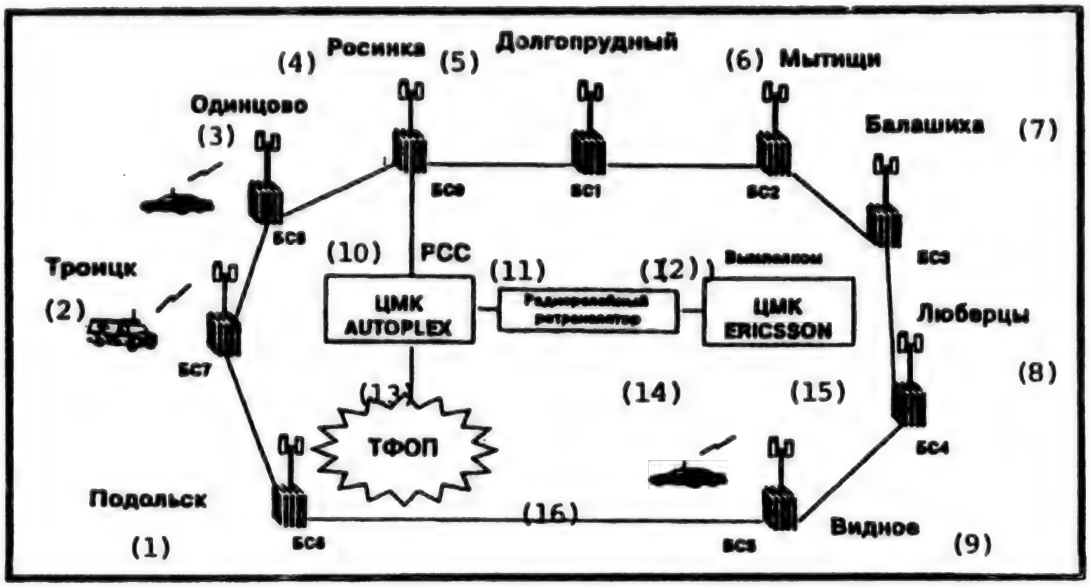

Key: 1. Podolsk 2. Troitsk 3. Odintsovo 4. Rosinka 5. Dolgoprudnyy 6. Mytishchi 7. Balashikha 8. Lyubertsy 9. Vidnoye 10. Base stations 1-9; 11. Regional cellular phone system 12. VympelKom 13. Autoplex mobile communications center; 14. Radio relay jsystem 15. Ericsson mobile communications system; 16. Public call office

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Apparatus and Methods for Strength Tests of Composite Materials at Temperatures to 3300 K

957D0006A Kiev PROBLEMY PROCHNOSTI in Russian No 9, Sep 94 (manuscript received 2 Dec 1993) pp 86-90

[Article by V. S. Dzyuba, A. V. Vysotskiy and S. V. Zubik, Strength Problems Institute, Ukrainian Academy of Sciences; UDC 620.1.05]

[FBIS Abstract] The conditions for use of carbon-carbon composite materials for thermally highly loaded structures correspond to a temperature 3000-3300 K, a pressure up to 150 atm and an aggressive medium. A number of approaches which have been used in attempts to ensure compliance with these specifications have failed to meet with full success. Accordingly, specialists in the structural strength laboratory at the Strength Problems Institute developed an apparatus for testing carbon-carbon composite materials for dilatation, compression and bending at temperatures up to 3300 K in a vacuum, air and an inert medium. This apparatus, constructed on the basis of a 198U10-1 test machine, is illustrated in a block diagram with 28 components identified to which the textual description of its structure and functioning is referenced. Technical decisions ensuring a uniform temperature field in the volume of a sample, methods for measuring deformation and temperature with increased accuracy and the program for an automated experiment are described. An experiment can be controlled either from a control panel or computer. In real time the computer is fed data on sample temperature at three points, on sample load and deformation as a function of type of tests. A special computer-coupled unit controls heating and loading. Software was developed for carrying out tests in real time, with stipulation of the temperature profile, for processing the collected information and storing it on a magnetic medium. A number of figures illustrate heating of the samples, sample used for dilatation tests and method for measuring its deformation and sample used in compression tests and method for measuring its deformation. Figures 4; references: 6 Russian.

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Dual-Use Materials in Transportation Vehicles (Based on a Paper Presented at a Conference on the Development Prospects of Metallurgical Science)

947F0235A Moscow TSVETNYYE METALLY in Russian No 8 Aug 94 [Signed to press 26 May 94] pp 43-47

[Article by B. I. Bondarev, G. S. Makarov, and V. V. Gulyayev, All-Russian Institute of Light Alloys [VILS]: "Dual-Use Materials in Transportation Vehicles (Based on a Paper Presented at a Conference on the Development Prospects of Metallurgical Science)"; UDC 669.71, 669.782]

[FBIS Translated Text]

Over the years, classified research in metallurgy created new alloys and new processes for their production. As a result, a defense technology was developed which often exceeded the best world standards. Application of these accomplishments in civilian industries will make it possible to greatly improve the quality of Russian products, making them competitive in foreign markets.

In the context of the military-to-civilian conversion, it became possible to use specialized alloys in civilian industries on a much wider scale.

Certain problems in improvement of the speed, reliability, and environmental cleanliness of modern transportation vehicles can be solved by introducing new materials, especially those which have passed muster in defense technology.

Special alloys and processes created for aerospace and defense technology can be effectively utilized in surface and water transportation, where stringent requirements are imposed in terms of the weight-to-freight ratio, corrosion resistance, and other physical/mechanical characteristics.

Aluminum Alloys

The efficacy of aluminum alloys in aircraft industry is well known. At the present time and for the near future, they are to remain the principal structural material in aviation. Aluminum alloys retain their dominant role in aircraft building because of the relatively slow development of the production of composite materials with organic matrix and also because of a higher cost of these composite materials, titanium alloys, and specialized high-strength steel. On the other hand, continuing research opens new opportunities for improving the functional characteristics of aluminum alloys, making them more competitive relative to other alternatives. These are aluminum alloys of a heightened purity, aluminum-lithium and aluminum-scandium alloys, granulated aluminum alloys, alloys for superplastic molding, laminated materials, and composite materials with an aluminum matrix.

For application of aluminum rolled products in the economy, the most interesting and promising areas (over 70% of the world consumption) are the following: transportation, construction, packaging and container production, electrical engineering, farming, cryogenic technology and heat exchangers, household appliances, and sports equipment.

Since the early 1970s, automobile makers have become more interested in the use of aluminum in cars. This was due to the following economic considerations:

- a lower car weight and, therefore, reduced fuel consumption;
- a substitute for scarce copper and corrosion-resistant steel;
- a greater raw material availability compared with other metals;
- a high efficacy of metallurgical reprocessing of aluminum components from old cars.

It has been estimated that a kilogram of aluminum in an automobile saves 7-10 liters of fuel during the life of the car, so the extra energy spent to produce this aluminum car is paid for seven-fold while the car is in service.

An analysis of the growth dynamics of aluminum use in passenger cars in Western countries shows that, by the year 2000, the total weight of aluminum assemblies and components will 120—150 kg (or approximately 10% of the total weight of a car).

The promise offered by the aluminum use is best illustrated by the Porsche 928, which contains some 300 kg of aluminum components, or 20% of its weight. The assemblies and components of motor cars made of deformable aluminum alloys are heat exchangers (radiators and heaters), bumpers, doors, trunk lids, hoods, cabin body, wheel disk, pistons, exterior and interior design profiles, truck sides, refrigerators, and fuel tanks.

A trend toward design and production of framework-based automobiles outside Russia requires the use of press-shaped aluminum alloys profiles. Ford has developed a new model, Synthesis 2010, mainly built of aluminum, which ensures the possibility of a virtually complete recycling of this car. The welded-aluminum body weighs 46% less than a similar-sized steel body. The car has a three-cylinder engine with an aluminum cylinder bank. The Synthesis 2010 is currently undergoing workshop tests under a program which seeks to determine the possibility of mass production of an automobile made almost entirely of aluminum. Regardless of the results of these tests, Ford is planning to expand aluminum use in its cars.

For a rapid and comprehensive solution of problems involved in a broader use of aluminum semi-finished components in automobile designs, close cooperation (including joint ventures) between car makers and automobile designers is organized in many countries. Joint scientific research and development work is carried out

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to create automobile designs, which are efficient in terms of aluminum use and include development of specialized alloys and semifinished products.

In Russia, the All-Russian Institute of Light Alloys [VILS] and specialized metallurgical factories have created alloys and processes for production of semi-finished components for automobile industry based on alloys and technologies used for production of semi-finished components in aircraft and space industries.

In particular, VILS and the KraMZ [expansion not given] factory have created a technology and introduced into large-series production at this factory high-precision tubes for radiators and heaters of passenger cars. These aluminum heat exchangers are installed on 50% of the VAZ cars and 100% of ZAZ cars. In the near future, aluminum radiators and heaters will be installed on the Moskvich and GAZ cars and buses.

A special mention should be made of aluminum uses in agricultural transportation vehicles, including cattle trucks, refrigerator trucks, flour carriers, and the bodies for trucks and trailers used for transportation of mineral fertilizers. Aside from reducing the weight of the truck body, the introduction of aluminum increases the payload, reduces transportation costs, saves fuel, and ensures good environmental indicators and a long service life of the vehicles. All-aluminum drop-side and dumpster platforms have been created for trucks and double trailers, including those used for intercity and international transit, two-wheeled trailers with drop-sides and gratings for aluminum-profile sheds, two-wheeled general-purpose semi-trailers, and refrigerator semi-trailers with various load carrying capacities.

The introduction of specialized large-size solid and hollow pressed shaped aluminum profiles with lock joints has reduced the work cost in the production of a truck body by a factor of 4, improving the appearance and service life of these vehicles. The profiles have also simplified the repair of truck bodies in the field conditions, making it possible to build various body configurations at the customer's discretion from a standardized set of modular profiles.

In view of the improved properties of aluminum alloys at low temperatures, mention should be made of their possible efficient use in the design of tracks for the harsh climates of the far northern regions in Siberia.

The cold-brittleness of steel is a well-known fact. According to estimates, an enormous amount of expensive alloying components would be needed to meet the nation's demand for cold-resistant steels. For instance, the bar of a bulldozer or the coupling of an automobile trailer can break like glass in subzero conditions. This problem can be easily solved today: the advantages of a light-weight resilient and unbreakable coupling in the conditions, for instance, of a Kolyma long-distance highway route are more than obvious.

Another area of application of aluminum-shaped profiles in passenger cars is the safety beam reinforcing the front door on the passenger side. Due to the higher damping capacity of aluminum compared with steel the beam mounted in the door protects the passenger from the most likely side impact.

Several years ago, our institute created a unique technology for production of aircraft wheels which feature a high quality, reliability, and serviceability, as well as a close approximation of the blank's shape to the shape of the finished wheel. The wheels for the Buran space shuttle were made with this technology with a metal utilization coefficient of 0.6. The experience gained in this project was utilized in the making of wheels for passenger automobiles, where the reliability and service life are no less important. The need for these wheels and the customers' interest exceeded all our expectations, because the car pick-up was increased substantially and at the same time a saving of fuel was achieved. The wheel weight was reduced by a factor of 2, simplifying the installation and reducing the total weight of the automobile.

A technology for production of stamped pistons of the Al-Si alloy AK12D, initially created for tank engines, increased the tank's service life by a factor of 1.5. Currently it is introduced into the car making industry, particularly for engines of the Ikarus bus.

Even better results were attained with tests of stamped pistons made of the 1379 alloy by using the fast crystallization method. The study showed (both when tested on tank engines and on the engine of KAMAZ-740 automobile) that the service life of the engine was doubled, the durability of the piston material was increased by an order of magnitude, the clearance between the piston skirt and the cylinder was reduced by a factor of 1.8, and a nonresistive insert was no longer needed in the piston design.

Aluminum alloys developed by VILS for aerospace technology, such as the high-strength alloys 01959 and 01969 (σ = 700—750 MPa) and the heat-resistant alloys 01419 and 01435 (with working temperatures up to 350°C), and produced with the fast crystallization method are currently being tested successfully in automobile and textile industry as substitutes for components previously made of steel:

- connecting rods, column gears (automobile industry);
- taking sticks, arms, and gears (textile industry) made of alloys 01959 and 01969;
- mufflers, exhaust pipes (automobiles industry) made of alloys 01419 and 01435.

The use of these high-strength and heat-resistant alloys in automobiles will greatly reduce the dynamic loads experienced by the power train, improve the corrosion resistance of products, lower the consumption of lubricants and fuels, and reduce engine noise. Of considerable importance for car making should be the introduction of

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fast-crystallized the aluminum alloy 01411, developed VILS, which has a high electric resistivity and could be used to make body components. This alloy has the mechanical properties of a low-carbon steel (σ = 200 MPa, δ = 20%). The alloy 01411 possesses virtually the same electrical resistivity as low-carbon steel (ρ = 10—12 $\mu\ \Omega$ cm). This makes is possible to build car bodies (where point welding is commonly used) from the alloy 01411 with the standard welding equipment currently used with low-carbon steel.

Car body components made of alloys 01411 will improve corrosion resistance and reduce weight by a factor of 1.5.

Aluminum reinforced with SiC or Al_2O_3 grains has been tested in the fabrication of internal combustion engine components (pistons, cylinder heads, sleeves, etc.) and other design elements (brake disks, engine-suspension brackets, etc.) for racing and sports cars of the new generation, and in general, by the sports equipment industry (bicycle frames and wheels).

High-silicon silumins (18—25% Si) produced by our new process should improve the reliability of internal combustion engine's piston pair by a factor of 2—4.

Since high-silicon silumins can be produced by a highly effective alumothermic method currently being developed, which involves direct recovery of inexpensive alumosilicate raw materials that is not processed by the conventional electrolysis technique, the cost will be reduced by a factor of 1.5—2.0 compared with silumins obtained by melting aluminum and silicon together.

The Volga Automobile Factory [VAZ] is now working on a program for creating, by the year 2000, a Russian aluminum car, and VILS is going to take a direct part in project.

Aluminum is widely used in railroad transport as well. In particular, by making axle boxes for railroad cars of stamped and pressed aluminum blanks the box weight can be cut in half. Due to the damping property of aluminum, the track load and the loads experienced by the railroad car elements are reduced by 10%. Aluminum axle boxes require virtually no repair or maintenance throughout their service life.

Because of the high corrosion resistance and good weldability of aluminum, it is used successfully to make railroad tank cars for transportation of concentrated hydrochloric acid, milk, liquor and wine, molten sulfur, and other chemicals.

Shaped profiles and other elements are widely used in railroad car interior design. By using 1 metric ton of aluminum in the interior trimming of a railroad car, the labor cost can be reduced is by 500 equivalent man-hours.

Tubes with internal plating of a corrosion-resistant aluminum alloy are used for water supply and heating in railroad cars. The technology for production of pipes with aluminum alloy plating was originally initially created under an order from the Ministry of Defense Industry for rocket engineering. The service life of these pipes is 10 times that of solid-metal pipes, and throughout the service life of a railroad car no pipe maintenance or repair is needed.

Because of the civilian conversion it became possible now to utilize large-sized aluminum panels, up to 800 mm wide, in the railroad car designs as elements of force-sustaining structures stretching along the entire car length.

All kinds of transportation containers of aluminum alloys have certain advantages over steel containers. They usually weigh half as much as the steel container and feature a much greater corrosion resistance, longer service life, and a lower operation cost because of a higher payload ratio and the fact that they require no painting.

Titanium Alloys

The development of the production of titanium alloys was mainly dictated by the needs of the defense technology. Achieving a high strength and higher working temperatures at a relatively lower density than for steel allowed titanium alloys within a short period of time to occupy an important place in the design of supersonic jet aircraft, rockets, gas turbine engines, and spacecraft.

Despite the ongoing structural changes in the consumption of semi-finished titanium products, the main consumers (70—80%) are steel, aircraft, and rocket and space industries, a situation expected to remain unchanged in the near future.

U.S., Japanese, and West European automobile makers have been using titanium alloys for the exhaust valve of the engine as a way to increase fuel efficiency. Low-weight titanium wheels and mufflers made for sports motorcycles are also sometimes produced for passenger cars and trucks.

In Russia, the use of high-strength titanium alloys (VT35) for production of elastic elements has been shown to be efficient. By making springs from titanium alloys, the weight is reduced by 55—60% and the corrosion resistance of the product is improved compared with that of steel.

For the future, titanium is expected to be used in the building and operation of high-speed magnetically levitated (magnetic suspension) trains. Titanium alloys in these trains are used to build the cryostats of the superconducting magnets of the rolling stock (to reduce car weight and noise). In the future, the demand for titanium and titanium alloys is expected to grow because of the importance of the issues of power supply, natural resource saving, and environmental protection.

Manufacturing of products operating in contact with seawater and aggressive media is an important sphere of

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use for titanium alloys. To prevent cavitation and corrosion of ship propellers and yacht steers, they are made of titanium alloys. In shipbuilding, deterioration of condenser pipes presents a considerable problem, because it results in contamination of boilers that slow the ship's speed or and can disable it. Titanium alloys in condenser pipes greatly prolong their effective service life.

Seawater desalination also relies on titanium alloys, which are used for tubes in the radiators of desalination plants.

The jacket-tube heat exchangers used in industrial and residential water supply systems are another promising area of titanium use.

Studies of the serviceability of titanium for these applications have demonstrated that it can greatly increase the service life of water steam heat exchangers by eliminating erosion and salt sediment.

Promising Materials and Technologies

VILS has worked out the scientific foundation of the processes and the set of equipment for industrial production of blanks for the disks of gas turbine engines of a complicated shape with an enhanced precision made of heat-resistant nickel alloys and fabricated by using the methods of granular metallurgy.

These disks exhibit an exceptional uniformity of properties throughout their volume and a minimal allowance required for machining (5—7 mm). The manufacturing of these disks for ship engines has begun.

Light heat-resistant alloys based on the γ-intermetallide TiAl, which feature a working temperature of up to 900 °C, are promising materials. These alloys are superior to heat-resistant alloys based on titanium iron and nickel in terms of elastic moduli and heat resistance in a broad range of temperatures. They also are characterized by a high heat resistance in air, incombustibility, and the absence of propensity to hydrogen embrittlement. An advantage of intermetallide alloys over conventional heat-resistant materials is absence of expensive alloying metals in their composition, such as tungsten and cobalt.

The granule GIP [gamma-intermetallide process] method with subsequent isothermal extrusion and isothermal stamping has been used to produce from γ-alloys various components of a complicated shape, such as the blades of gas turbine engines.

The granule GIP method can be employed to produce piston linings for diesel engines which increase the engine power by 20—30% without changing the dimensions of the combustion chamber.

Mechanical alloying produces new materials with a new set of physical/mechanical properties that cannot be obtained with other metallurgical methods. For instance, the heat-resistant and high-temperature dispersely reinforced VPM-2 steel can work for a long time in aggressive media at temperatures up to 1350 °C, is highly resistant to oxidation and sulfide corrosion and can be used to build heavily loaded engine components, such as the fuel pre-injection chamber, diesel engine swirler, and also pins, dowels, and keys operating in the hot zone.

Corrosion resistant steel can be used in exhaust systems of automobile engines: exhaust collectors, pipes, muffler components and bodies, inner components and bodies in exhaust gas toxicity catalytic neutralizer systems.

Tests of prototypes by our customers at defense design bureaus, as well as at UAZ [Ural Automobile Factory] and ZIL [Automobile Factory imeni Likhachev], have demonstrated the desirability of pursuing this line of research.

Ceramic components made of materials based on silicon nitride and carbide, feature better service characteristics than products made of conventional materials. These materials are intended for operation in critical assemblies of future power plants, including wear-resistant and temperature-durable components and assemblies, such as combustion chambers, blades and disks of gas turbine engines, superchargers and heat exchangers, cylinder inserts, piston plates, valves, heat resistant inserts of plunger cams, and ceramic and hybrid-type bearings.

A number of firms abroad are currently using promising materials similar to those created at VILS (Daimler-Benz, Chevrolet, Pontiac, Ford, Renault, Fiat, Toyota, and others).

A decade of experience with the use of components made of new materials has demonstrated their higher efficiency: it was possible to improve the engine power output to 80 horsepower/liter and more; the weight of cars was greatly reduced (Ford claims that the weight of the equivalent average car has been decreased by 565 kg); the toxicity of exhaust fumes was lowered; the fuel consumption was reduced; noise level was suppressed, and several other advantages were achieved.

The efficiency of the civilian industrial use of materials created for defense and for special engineering is estimated by way of economic analysis, because these materials are usually expensive, often contain scarce components, and require specialized equipment and tools and highly skilled work force for processing. Quite often, however, a minor modification in the composition of the alloys and simplification of the processes could expand the range of their cost-effective application.

The dual use of new alloys broadens the opportunities for finding new financing sources for development of their industrial applications, something extremely important in the new economic conditions of the military-to-civilian conversion.

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Cryogenic Technology in Ukraine

947F0240A Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 6 Jun 94 [Signed to press 16 Jun 94] pp 20-22

[Article by V. I. Bova, A. S. Starets, doctor of technical sciences, and N. V. Samusenkov: "Cryogenic Technology in Ukraine"; UDC 621.593(477)]

[FBIS Translated Text]

Scientific Research Institute of Cryogenic Machine Technology [NIITkriogenmash] and the Odessa Avtogenmash Factory (which previously were parts of the Kislorodmash Research and Production Association) plan to develop and manufacture the following types of cryogenic technology:

- air-separating plants [VRU] of the stationary type with a capacity of up to 5000 m^3/hr of air processed;
- stationary VRU with output exceeding 5000 m^3/hr of air processed (up to 2500 kg/hr of liquid oxygen and nitrogen processed);
- installations and units for comprehensive scrubbing and drying of compressed gases (including methane gas), filters and separators (VRU equipment for comprehensive air cleaning the produced by the Odessa Avtogenmash Factory);
- installations for production of rare gases (including helium purification plants for nuclear power plants);
- gasification installations, cryogenic gasifiers, automobile gasification plants for liquefied gases;
- transportation and stationary isothermal tanks for liquefied carbon dioxide with capacity up to 2 m^3 and other vessels;
- gasifiers of liquefied carbon dioxide and carbon dioxide chargers (dispensers);
- plunger pumps for liquefied gases and pumps for cryogenic liquids;
- turbine expansion engines and turbine centrifugal expanders for VRU made by the Odessa Avtogenmash Factory;
- a series of specialized airfield fueling dispensers for oxygen, nitrogen, and carbon dioxide in an autonomous transportation version and equipment for rocket installations.

The institute and the factory have a sufficient number of skilled design and development engineers for fulfilling diverse customer orders in these areas of cryogenic equipment.

Aside from these types of equipment, the institute and the factory develop, design and produce autogenous welding systems, including the following:

- straddle machines for thermal cutting (oxygen and plasma types) with the portal width from 2.5 to 12 m and various automatic control systems;
- thermal cutting machines (joint-supported, portable, and straddle-cantilever type for cutting of pipes and shaped rolled products);
- oxygen and plasma tools (machine cutters) for various machine types;
- autogenous welding equipment and machines for metallurgical factories and rolling shops;
- hand-held cutters and torches fueled with various combustible gases;
- adjustment, servicing, and spare parts manufacturing are offered for all kinds of equipment at customer's request.

In addition to equipment development, NIITkriogenmash also designs production processes associated with cryogenic and autogenous welding technology and retooling of machine-building enterprises, designs various workshops and production sections for various industrial operations, and develops production processes for machine building enterprises (starting from the production of blanks to the final assembly section).

NIITkriogenmash has a long track record in the development and introduction of systems for computer-aided design of engineering processes [SAPR-T] run on computers of various classes. It has a considerable experience in SAPR-T development for various engineering processes and types of industrial activity.

In 1991-93, dislocations in the economy resulted in a significant reduction (up to 50%) of the basic list of products manufactured, but the overall amount of commercial output was not reduced. The shortfall was offset by other job services and new types of commercial activities, making it possible to retain the staff and the research and industrial potential at the 1991 level without layoffs and other negative social implications and preserve all the structural units of the organization. In order to improve economic independence and stability under the difficult economic conditions, some of the production lines were spun off as separate small state-owned enterprises and firms, but the activities of all these units are coordinated and guided by integrated technical and economic policies. These new economic entities operate as legally independent units based on leasing and cooperation arrangements for supplies, sales, and financing. The basic principles of these activities are defined by the firms' charter documents.

As a result, it became possible to expand activities based on direct contracts with customers for the development and introduction of new types of equipment:

- multi-component and multi-mode VRU for simultaneous production of liquid and gaseous oxygen, nitrogen, and argon;
- several acetylene compressor stations with outputs of up to 40 m^3/hr;
- turbine engine expansion units with output up to 30 t/hr for liquid fraction of hydrocarbon gases;
- modular-block systems (pumping-evaporator systems) for gasification units operating in conjunction with any containers of liquefied oxygen, nitrogen, and argon;

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- cistern containers for transportation of liquefied carbon dioxide on all types of vehicles;
- a straddle-type thermal cutting machine with combined oxygen and plasma support equipment;
- a machine for selective fire-cleaning of slabs and bloomings;
- technological support complexes for straddle machines with mobile cutting tables and slurry removal carts and ventilation fans.

Almost all equipment and processes of the organization are protected by patents in Ukraine and other CIS countries, and other nations. NIITkriogenmash is the proprietor of these patents.

Currently, NIITkriogenmash and the Avtogenmash factory are enterprises owned by the state of Ukraine. The Ministry of Machine Industry of Ukraine functions as the owner's agent; the activities of the institute and the factory are regulated by charters. NIITkriogenmash also function as Ukraine's leading research organizations in the area of cryogenic and oxyacetylene welding technology.

In 1992-93 the institute conducted preliminary analysis and outlined the plans for the development of cryogenic and oxyacetylene welding technology, as well as expansion of the activities of the institute and the factory. NIITkriogenmash and the Avtogenmash factory are prepared for contract-based business cooperation and partnership with enterprises, organizations, and business groups in Russia and other CIS countries as developers and manufacturers of above-listed conventional equipment and design of new types of equipment.

The following cooperative projects appear of interest to us and are offered for review as preliminary proposals:

1. Development of a set of equipment for natural gas liquefaction, storage, transportation, and fueling, as well as equipment systems for transportation facilities (all types of land, water, and air transport) making it possible to use liquefied methane as motor fuel. A number of organizations in Ukraine have expressed interest in this project.

2. Development of equipment systems for air separation using sorption methods with zeolites and "molecular sieves."

3. Development of equipment for production of ozone and ozonation equipment (purification units) for water and effluent treatment.

4. Development of portable equipment systems (high-pressure nitrogen stations) to intensify oil production and increase outflow in production wells and formations.

5. Development of various firefighting systems using liquefied carbon dioxide for museums, art collections, libraries, etc.

6. Development of mobile firefighting systems for coal mines using nitrogen or carbon dioxide.

7. Development of ship firefighting systems and inertial-gas facilities using liquefied carbon dioxide for tanker ships and vessels transporting hazardous cargos.

8. Development of equipment for extraction of substances from plants (for the food, cosmetics, and pharmaceutical industries) based on high-pressure cycles with the use of liquefied carbon dioxide.

9. Development of equipment for utilization (liquefaction) of exhaust gases using cryogenic technology.

10. Development of equipment systems for utilization of the tail gases of ammonia and other chemical plants based on a cryogenic technology.

11. Development of equipment for production, storage, and use of biological gases and concomitant products at life stock farms.

12. Development of nitrogen technologies and creation of equipment using cryogenic processes for food, chemical, and other industries (including transportation, storage, and processing of perishable foods, medicinal raw materials of a plant or animal origin, recycling of various industrial wastes, spent products, and packaging materials, production of highly dispersed powders of organic and inorganic materials). Creation of protected atmospheres and controllable gas environments, medical equipment and instruments using cold for therapeutic procedures, installations for cold treatment of machine components, fast freezing of various objects, dry freezing, effective fire extinction, etc.

13. Development of compressors, generators, and other equipment for acetylene production facilities and acetylene applications.

14. Development of equipment for laser and gas-laser cutting and welding, based on thermal cutting machines.

15. Development of equipment for the construction industry based on straddle thermal-cutting machines (plasma-coating of air-resistant decorative paint on structural elements of buildings).

16. Development of a thermal cutting system for dismantling of decommissioned metal structures (frames, ships, armored vehicles, scrap metal, etc.).

17. Development of cryogenic systems of special-purpose equipment for airfields, launch pads, aircraft, rocket, ship engineering, etc.

Many of these areas of endeavor are aimed at improvement of the environmental conditions in the CIS countries; some of these projects (items 3, 9, 10, 11 and 12) are largely concerned with solution of environment problems.

Other proposals for design and development projects in areas where our knowledge, skills, and potential can be utilized will also be welcome.

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Resistance Models and Behavioral Features of Stability Loss in 3-Layer Shells of Composite Materials

957F0032A Moscow PROBLEMY MASHINOSTROYENIYA I NADEZHNOSTI MASHIN in Russian No 5 Sep-Oct 94 (manuscript received 31 Mar 94) pp 57-62

[Article by S. N. Sukhinin, Kaliningrad, Moscow oblast; UDC 624.0 74:678.067]

[FBIS Abstract] There are dozens of parameters that characterize the stability of composite material structures. This makes it difficult to determine the underlying resistance laws for three-layer shells and to obtain formulas suitable for design work. This paper examines the behavior of three-layer cylindrical shells of composite materials in axial compression. Three generalized rigidities are established which define critical stresses. Criteria for the applicability and errors of various resistance models are developed for three-layer structures. A criterion is proposed for the effectiveness of three-layer shells in axial compression. The effect of limit conditions and initial imperfections on the critical stresses are studied for three-layer shells. References 6 (Russian).

Reasons for the Low Reliability of Ground-Water Pumps and Methods of Increasing It

957F0032B Moscow PROBLEMY MASHINOSTROYENIYA I NADEZHNOSTI MASHIN in Russian No 5 Sep-Oct 94 (manuscript received 25 Apr 94) pp 77-86

[Article by L. I. Pogodayev, Yu. N. Tsvetkov, St. Petersburg; UDC 62-192:658.382.3:656.62]

[FBIS Abstract] This paper examines the problem of increasing the reliability of ground-water pump parts subject to high-intensity hydroabrasive wear. Also studied is the effect of operating modes on the flow structure of a soil mixture in the flow-through channels of the pump and on the rate of local and overall wear of parts. A method of optimizing operating conditions is proposed which includes matching the hydraulic and geometric characteristics of pumps operating at low pressures by establishing the optimal external diameter of the impeller. A structure and energy model of wear is proposed which considers operating modes, features of ground-water pumps (for example, hydraulic efficiency), intensity of eddy formation in the impellers, and the anti-wear properties of materials in the form of the critical density of deformation str ength. Figures 3; references 4 (Russian).

Calculated Justification Method for the Technology of Restoration Repair of Cellular Structural Elements

957F0032C Moscow PROBLEMY MASHINOSTROYENIYA I NADEZHNOSTI MASHIN in Russian No 5 Sep-Oct 94 (manuscript received 4 Apr 94) pp 90-97

[Article by M. N. Semin, Moscow; UDC 539.3:519.6:62-112.8:629.7]

[FBIS Abstract] A system of calculation methods is proposed to justify the technologies for restoration and reinforcement of cellular structural elements of aircraft with damage to the glued mechanical joints of metals and composites. The structural elements studied bear small to intermediate loads. The types of damage and corresponding repairs are described. Stresses acting on the repaired joint are considered in the determination of an optimal repair scheme. The distribution of forces is examined. Results of an experimental study of the durability of restored elements are presented. It is shown that there is a smooth redistribution of rigidities in glued joints with beveled edges with a decrease in tangential stresses by 40-50% and a reduction of normal stresses by 50-60% in the glue layer. Mechanical bracing should be placed outside the zone of transmission of stresses in the glued joint. Surface and penetrating cracks do not lead to stratification of the glue layer. Fig ures 5; references 5: 4 Russian, 1 Western.

New Mechanisms of Relative Manipulation

957F0032D Moscow PROBLEMY MAS HINOSTROYENIYA I NADEZHNOSTI MASHIN in Russian No 5 Sep-Oct 94 (manuscript received 31 May 94) pp 106-117

[Article by A. F. Kraynev, V. A. Glazunov, Moscow; UDC 621.01]

[FBIS Abstract] A class of mechanisms is formulated which reproduces given trajectories of points and positions of bodies in a moving system of coordinates. An analogy with the relative manipulation of two hands is presented, as well as examples from the history of technology. Conditions are defined for the existence of solutions for mechanisms of a given class. New technical solutions are presented. Algorithms are developed for structural synthesis, kinematic analysis, and stress analysis. This method makes it possible to obtain combinations of closed planar mechanisms, rotating pairs, and positioning of drives that increase the accuracy of reproduction of three-dimensional motions, speed, and efficiency. This can be used for processing or assembly of lightweight parts. Figures 5; table 1; references 5 (Russian).

System for Localizing Sarcophagus of Chernobyl NEP

957F0034A Kiev ENERGETIKA I ELEKTRIFIKATSIYA in Russian No 5 Sep-Oct 94 (manuscript received 18 Mar 94) pp 38-41

[Article by V. N. Matichuk, engineer, L. S. Bravin, engineer, B. V. Solukha, doctor of biological sciences, V. V. Rozhkov, doctor of physical and mathematical sciences, "Energoproyekt" Institute, VNIITAG, Kharkov Physicotechnical Institute; UDC 621.039.551.521+502.7]

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[FBIS Translated Text] Issues of the optimum approach to the problem of ecological safety of the power generating unit at Chernobyl Nuclear Electric Plant (ChNEP) destroyed as a result of the accident have now become especially urgent.

In November of 1986, a sarcophagus was built to cover the destroyed generating unit.

For the past seven years, the structural components of the enclosure have been subjected to the alternating action of humidity and temperature, and have been gradually losing their strength properties.

In conducting an international competition on converting the sarcophagus to a long-term ecologically safe system, one of the goals was to combine work on the enclosure with operation of the existing generating units, as well as possible performance of work on dismantling, reprocessing and transportation of fuel-containing and radioactive materials located inside the sarcophagus.

In the opinion of the authors, it would now be advisable to resolve the problem of making an ecologically safe system for localizing fuel-containing masses and radioactive materials located in the enclosure without removing them. In this regard, the authors have done studies and calculations leading to the decisions set forth in this paper.

Within the sarcophagus there is a lot of radioactive dust that could be a major hazard if released into the environment.

The outlook for behavior of residues of fuel-containing masses and radioactive materials in the sarcophagus suggests several kinds of dangerous changes:

- destruction of the surface of lava-like materials, leading to the occurrence of fuel dust;
- formation of new uranium compounds (carbides and the like) on the lava surface, including soluble compounds.

Radiation-chemical reactions result in reversible and irreversible processes that cause a change in properties of some materials and formation of new compounds that have an environmental impact.

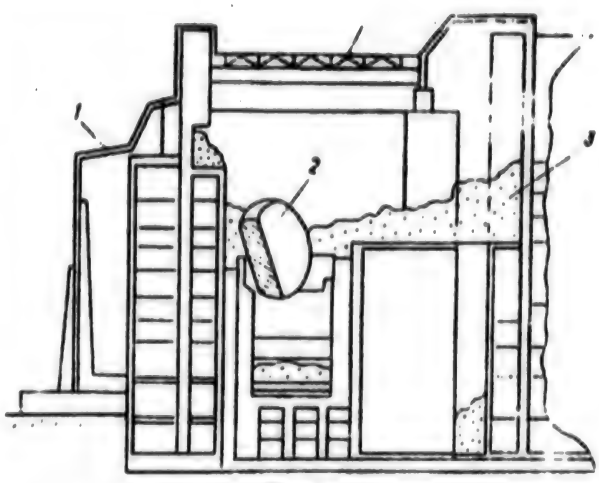

Fig. 1.
Sarcophagus of ChNEP. Cross section: 1—sarcophagus of fourth generating unit; 2—upper plate of reactor biological shielding (shifted as a result of the accident); 3—radiation materials produced by the accident

Contamination of the environment following the accident on generating unit No 4 has been mainly due to cesium-137, strontium- 90, ruthenium-106, cerium-144, americium-241 (decay product of plutonium-241) and so on, in the form of microparticles of radioactive dust.

Radioactivity has also been carried into the environment with water in rooms of the sarcophagus.

Calculations done by VNIITAG Institute in Kiev on concentrations of radionuclides in atmospheric air with 10% escape of radioactivity from the enclosure show that RCG_a and RCG_b are exceeded.

In calculating the near-ground concentration of radiation activity on the boundary of the 30-km zone around ChNEP, the generalized element cesium-137 was considered with mass and activity equal to the sum of all elements now in the sarcophagus; no allowance was made for the background (existing) contamination of the environment. (Calculations were done by the "EOL" program produced by OND-86).

The table summarizes the calculated near-ground concentration of radiation activity on the boundary of the 30-km zone.

Radionuclide	Parameters of emissions from sarcophagus					Level of radiation concentration of activity, Ci/m^3
	altitude of emission H, m	T, °C	% of volume	time, days	rate of fallout, cm/s	
Cesium-137	50	100	10	1	1	9×10^{-7}
Ditto	100	100	10	1	1	5.5×10^{-7}

It should be noted that during the accident on generating unit No 4, total emissions were of the order of 3.5 percent of the total amount of radionuclides in the reactor at the time of the accident.

At present, the sarcophagus can be considered a totally acceptable structure for localizing radioactivity, given that the strength properties of the structural components are reinforced and joints in the coverings are made leak-tight (Fig. 1).

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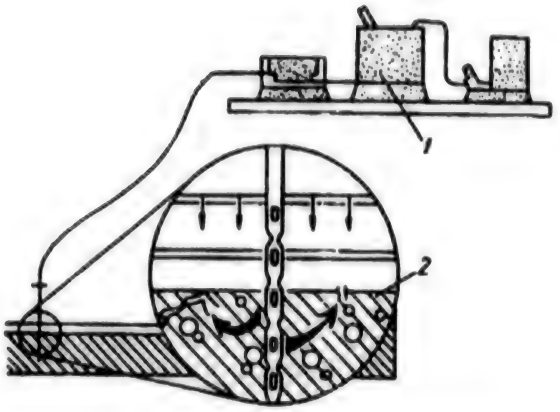

Fig. 2.
Diagram of reinforcement of structural components and sealing of coverings: 1—facility for preparing and feeding polymer composites; 2—monolithizing unit of structural component or foundation

Described below are some steps that could be carried out on the sarcophagus to localize the damaged power generating unit with further dismantling.

Suggested engineering measures aimed primarily at preventing escape of radioactivity into the environment are as follows:

Reinforcing structural components and sealing leaks in coverings of the sarcophagus in accordance with developmental work of the science and engineering services center based at KHfVS NAN of Ukraine "Monolittekhnologiya" (Fig. 2). To increase the load-bearing strength of columns, concrete piers and cascaded walls of the sarcophagus, polymer composites are used that are based on copolymers of isocyanates with sodium silicate added, which have high penetrating power (rate of setting is controllable from 5 minutes to 10 hours) and high strength (compression strength 250- 280 kgf/cm^2).

In the case of restricted access to places that are to be reinforced, the composites are put into vials that are remotely delivered to the required places and broken. As a result, the contents of the vials are dispersed and flow into various cavities, producing a steel-polymer lining in a short time (less than 2 hours).

To seal up coverings of the sarcophagus, the surface is monolithized by mechanical injection of liquid polymer preparations into various gaps, which harden with resultant reduction of filtration properties and improvement of mechanical strength.

For jobs of this kind, working preparations of "Monolit" composite have been formulated with characteristics that can be varied for surfaces of any complexity.

Composites of "Monolit" type are prepared either under conditions of chemical plants, or on site at ChNEP from the initial components by mixing.

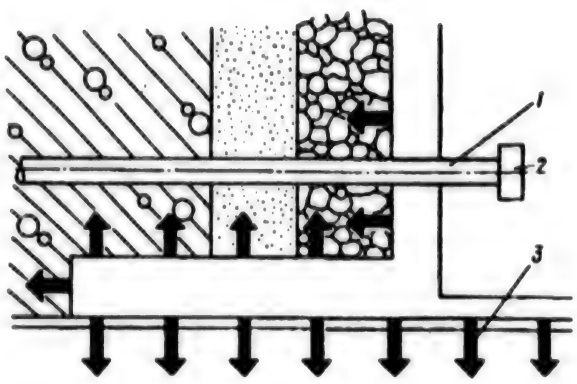

Fig. 3.
Monolithized unit: 1—tube for removal of residual heat emissions; 2—filter; 3—injection of liquid polymer material (composition)

The work can be done by using any kinds of pumps designed for operating with oils, construction materials and chemical solutions.

The following materials are used to reinforce load-bearing members and base footings, and also to monolithize the surface of the sarcophagus:

- polymer composites of "Monolit" type that have low viscosity and high compression strength;
- polymer cement "SPRUT-5" that has low viscosity of the adhesive composite after mixing of initial materials.

Localizing radioactive materials inside the sarcophagus. This goal is achieved by monolithizing (cementing) fuel-containing masses (FCM) and other radioactive materials (Fig. 3).

In the sarcophagus, most of the rooms (spaces) have MED of ionizing radiation of less than 1 r/h, where the aforementioned method of monolithizing the surface of FCM is used.

As a result of hard ionizing radiation inside the enclosure, in time the strength of coverings may be lost; in this case, monolithizing of the surface of FCM is repeated.

However, there are places where the MED of ionizing radiation is much greater than 1 r/h: rooms of the first floor of the pressure suppression pool, sub-reactor rooms, central hall of the reactor room and some others. In these places it is recommended that synthetic polymers of the polyimide class be used, for example polypyromellitinide, polyacrylonitrile or foam polyimide [1].

The use of specific polymer materials and development of processing instructions are determined after research by the staff of the analytical research center of the Ukrainian Science Center at Kharkov Physicotechnical Institute. The Center has the capability of doing this research in minimum time.

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Polymer materials of the polyimide class have the following properties: they are non-volatile, they acquire fluidity at high temperature, they are capable of forming fibers and films with high heat resistance and radiation strength. Polymer materials that consist mainly of carbon and hydrogen are good absorbers of ionizing radiation.

In places where the dose rate of ionizing radiation is tens and hundreds of roentgens per hour, a system has been devised that consists of stainless tubes provided with filters to carry off residual heat emissions.

Doing work under conditions of elevated radiation. To perform work under such conditions, remotely controlled systems are used with robotic equipment or manipulators that can perform a variety of operations both on the enclosure and inside it.

Systems of remotely controlled equipment (robotics, manipulators) have now been developed that have several degrees of freedom, can transfer loads, are provided with a telemetric and laser system for determining places where work will be done, and have several modes of performing operations in a radiation environment (mode of remote control, work in accordance with a preset program, and so on).

For controlling operations, a shielded control station has been set up in direct proximity to the sarcophagus that is equipped with systems providing for the following:

- monitoring the status of the sarcophagus, including measurement of temperatures, stresses in structural components, exposure dose rate of ionizing radiation, isotope composition, activity of basic long-lived radionuclides, and radiation monitoring of leakage into the environment;
- monitoring the radiation environment on the industrial site and contiguous territory (observation zone);
- monitoring the status of operating power generating units that may be in service at the time of creating the system for localizing the sarcophagus, outputting initial information for working out recommendations;
- on the course of work using a computer information system such as the Bailey Company's latest distributed digital control system INFI- 90, systems made by Siemens, Segelec, Westinghouse or Monolit in Kharkov;
- on radiation and nuclear safety when doing work involving setting up and operating the sarcophagus localizing system (SLS);
- on fire-fighting steps, organizing and carrying out emergency measures in the case of forced destruction of the sarcophagus and/or damage to working generating units;
- forecasting the situation based on data coming in from information sources (from the sarcophagus, generating units and the ASKRO system [computer-aided system for monitoring the radiation situation]);
- listing operations and their sequence for optimizing job performance.

A control station equipped with one of the aforementioned computer systems will enable complete automation of work on creating the SLS.

The required jobs are done by robotic equipment and/or manipulators under remote control from the shielded control station.

Companies like Power Cutting [2] and Hispano-Siuza [3] have developed systems of remotely controlled equipment under conditions of hard ionizing radiation.

After setting up the SLS and stabilizing radioactivity inside the sarcophagus, work could be done on removal and subsequent burial of radioactive materials by using remotely controlled systems, thus eliminating human participation in removal of radioactive materials from the enclosure.

Technologies for processing nuclear fuel and radioactive waste are well known: dissolving them in acids, incinerating, and immobilizing wastes into solid monolithic form and then burying in special repositories [4].

Since the accident that occurred on generating unit No 4 of ChNEP, radioactive contamination of the natural environment in a 30-km zone has precluded habitation and agricultural activity by humans without harm to health.

Based on the foregoing, it is advisable in approaching the problem of immobilizing the sarcophagus and transforming it to an ecologically safe system, to start work on cleaning up the environment in the observation zone.

Plans have now been worked out for cleaning contaminated ground of radionuclides, heavy metals and other potentially hazardous elements by using mobile ground-washing facilities.

CONCLUSIONS

1. Our calculations on assessing the possible environmental impact of radiation show that in view of the low probability of destruction of the sarcophagus, the decision to reinforce load-bearing structures and base footings of the enclosure and to seal up coverings can be considered justifiable from an economic and engineering standpoint.

2. Removal of radioactive materials and dismantling of the sarcophagus should be done only after stabilizing radioactivity inside the enclosure by employing established technologies for processing nuclear fuel and high-level wastes with the use of remotely controlled equipment provided with computer systems used in creating the SLS.

3. Nuclear, radiation, ecological, general engineering and fire safety are monitored in the SLS by a computer information system installed in the shielded control station.

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4. Since technologies are presently available for cleaning ground of potentially hazardous elements, one of the tasks in localizing the sarcophagus should also be taken as cleaning up the ground in the 30-km zone.

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Development of Projects To Use a Highly-Concentrated Water and Coal Suspension in Power Engineering in Russia

957F0053A Moscow TEPLOENERGETIKA in Russian No 11 Nov 94 pp 26-29

[Article by K. N. Tr ubetskoy, I. Kh. Nekhoroshiy, Russian Academy of Sciences, Ministry of Science of Russia; UDC 662.62.004.3]

[FBIS Abstract] A highly concentrated hydrocarbon suspension can be used as fuel in the steam boilers of thermal electric power plants and in low-power group and individual boilers. The suspension is an artificial composite dispersed system based on coal and water (natural water or industrial liquid by-products). Its composition and properties can be manipulated. This type of fuel substantially increases the thermal and ecological properties of coal. The coal can be modified by removing oxygen compounds, reducing its ash content, and decreasing its sulfur content. No chemical or thermal methods need be used to create the fuel. Another advantage is that this fuel facilitates the use of sulfurous coals and makes them a cleaner burning fuel. A 262 km pipeline form Belovo to Novosibirsk is in place and in operation, transporting 1.2 million tons of fuel per year. Research is continuing to improve the content and stability of the suspension and to find more effective transport, storage, and combusti on methods. It is shown that when the suspension is transported in tanker trucks (10 m^3 in volume) for 850 km the difference of the concentrations of the solid phase at various levels in the tank is only 1%. A boiler loaded with 75-80% of this fuel and 20-25% dry coal yielded a 17-20% reduction in the underburning of fuel, a 14-18% increase in efficiency, a reduction by a factor of 2.5 in No_n emissions, and a factor of 3 reduction in solid particles in the emissio ns. Table 1.

Use of Biomass By-Products of Forestry for Power

957F0053B Moscow TEPLOENERGETIKA in Russian No 11 Nov 94 pp 30-35

[Article by L. V. Zysin, N. L. Koshkin, F. Z. Finker, Energotekhnologiya, Ministry of Science of Russia, Pol itekhenergo joint stock company; UDC 620.9.577.4]

[FBIS Abstract]This paper presents data on the potential, technology, and use of vegetable biomass as a fuel. The advantages and drawbacks of this type of fuel are examined. Three types of use are considered: direct combustion, gasification, and liquefaction, which is in the experimental stage. The difficulties involved with each method and their economic competitiveness are examined. Positive results were obtained in a direct combustion method using low-temperature vortex combustion. Gasification is close to the large-scale introduction stage. Gasification yields a cleaner burning fuel than direct burning of solids, and is attractive due to the rising prices for natural gas. A key factor in the gasification process is drying of raw materials, and systems to dry solid biomass and create gas are described. A table compares the technical and economic features of using biomass. Data are presented for Russia and foreign countries that are using biomass energy. Figures 3; tables 4; references 8: 6 Russian, 2 Western.

Biogas Technology: A Radical Solution to Problems in Ecology, Power, and Agrochemistry

957F0053C Moscow TEPLOENERGETIKA in Russian No 11 Nov 94 pp 36-42

[Article by Ye. S. Pantshkava, EkoRos Center joint stock company; UDC 577.3]

[FBIS Abstract]This paper describes original methods of converting biomass (mainly animal husbandry by-products) into energy, as well as ecologically clean equipment to carry out this process. The yield of biogas from various types of waste are listed. Use of biomass is attractive because it solves ecological problems (the elimination of waste products), provides energy, and yields clean fertilizers to increase the productivity of soil. Biogas resources are enumerated. It is estimated that up to 95 billion cubic meters of biogas per year could be produced, which can then be converted into electricity and heat. A by-product of the conversion of biomass to fuel is 140 million tons of fertilizer per year. Several technologies have already been developed to produce biogas, and these systems are described and illustrated. Figures 10; references 3 (Russian).

Externally Heated Liquid-Piston Engine and Areas of Application

957F0053D Moscow TEPLOENE RGETIKA in Russian No 11 Nov 94 pp 69-72

[Article by I. T. Atmanov, V. M. Yeroshenko; UDC 621.1./088.8]

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[FBIS Abstract]Steam and combined steam-gas models of an externally heated liquid-piston engine are shown. These engines can be used in heating and cooling systems, compressors, pumps, and generators. They may also be used to equalize temperature fields or to harness stack heat. The engine consists of the following elements connected in sequence: steam generator (evaporator), adiabatic steam-liquid channel, condenser (refrigerator), and a pressure-suction channel connected to a converter. The interior of the engine is filled with a fluid which acts as a piston and a working fluid. Reciprocating motion is then established. Although it has a low efficiency, the engine has the advantage of having no mechanical moving parts. It can move coolant or a heating agent faster and over longer distances than a conventional device. A two-component, two-phase (liquid and gas) working fluid boosts efficiency. Other advantages of the two-component two-phase version of this engine are enumerated. Advantages over the Sterling engine are noted. Possible applications of the engine as a stand-alone device or as a component are listed. Figures 2; references 7 (Russian).

Main Trends for the Development of Power Engineering in Lithuania

957F0053E Moscow TEPLOENERGETIKA in Russian No 11 Nov 94 pp 73-77

[Article by V. P. Mishkinis, Lithuanian Energy Institute; UDC 620.9 (474.5)]

[FBIS Abstract] This paper analyzes the current state and prospects for the development of power engineering in Lithuania to the year 2010 with a consideration of structural changes in the economy and limits on available resources. While Lithuania's per capita heat and energy production levels rival those of many developed countries of Western Europe, its economic development has lagged behind. Scenarios for intense and limited economic development have been considered, and their effects on the annual growth rate of the economy calculated. It is recognized that fuel and energy must be used more efficiently. Two levels of projected energy consumption based on two different scenarios of development of the industrial sector and demographics are considered. Factors used in the determination of energy consumption levels are listed. Levels of energy consumption in several areas of the economy, past, present, and projected, are given in a table. Studies have been conducted to determine effective energy conservation methods for various areas of the economy. Conservation is of great importance because Lithuania must import fuel for its energy needs. Central heating systems are noted as a key energy waster, and top priority is given to decreas ing losses and increasing efficiency. The future of Lithuania's nuclear power plants is considered. Expansion of the use of hydroelectric power is seen as an important factor in reducing foreign imports of energy. Recently discovered oil deposits in Western Lithuania are discussed. A table presents the past, present, and projected balance of fuel resources in Lithuania. Figures 2; tables 3; references 4 (Russian).

Linear and Discontinuous Induced Oscillations of Flow of Bubbly Fluid in Deformable Pipe (Review)

957F0055A Kiev PROBLEMY PROCHNOSTI in Russian No 9 Sep 94 (manuscript received 28 Feb 94) pp 3-29

[Article by Sh. U. Galiyev and T. Sh. Galiyev, Strength Problems Institute, Ukrainian Academy of Sciences; UDC 539.4]

[FBIS Abstract] On the basis of data cited in numerous publications an analysis is made of the possibility of excitation of shock waves in a flow in a pipe. The source of disturbances selected was a piston oscillating at one end of a pipe having a nozzle at the other end. Equations are derived for the flow of a bubbly fluid for the case when long waves are propagated in it and a velocity potential is present. Different variants of formulation of the boundary conditions for the nozzle are given and methods are described for solving the boundary value problem near and far from the resonance frequencies. The theoretical results obtained using passage to the limit for a gas flow are consistent with those published by other authors and experimental data. It was found that there are frequencies at which periodic hydraulic shock waves are generated in the considered pipes. Their amplitude is much greater than the amplitude of the shock waves generated at resonance in a gas column. By varying the initial content of the gas in the mixture, the acoustic properties of the nozzle and the elastic properties of the pipe it is possible to control the flow oscillations, change the resonance frequencies and eliminate or generate hydraulic shock waves. With a coincidence of the frequency of the oscillations of the hydraulic shock waves and the natural frequency of the pipeline it may experience large movements, which eventually results in destruction of the pipe or support due to fatigue. Since the considered problem includes elements of acoustics, hydromechanics, the theory of multiphase media and elasticity a number of simplifying assumptions were introduced. Only long waves and a one-dimensional formulation of the mathematical problem were considered. A still greater limitation is caused by neglecting the possibility of a considerable change in the gas content of the mixture in the course of its oscillations. The examination of nonlinear oscillations was made only for the case of nozzles whose acoustic properties are close to the properties of a closed pipe end. In addition, the analysis of oscillations is made without allowance for mass forces. [The essential content of the article was published by the authors under the title "Resonant Waves in Deformable Tubes With Nozzle" in ENG. AERO-HYDROELASTICITY, Vol 2, pp 310-315, 94.] Figures 6; references 60: 31 Russian, 29 Western.

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Sealed Lead Battery With Copper Negative Lead

957M0016A St. Petersburg ZHURNAL PRIKLADNOY KHIMII in Russian Vol 67 No 3 Mar 94 pp 398-401

[Article by M. V. Lushina and G. A. Kolikova, Battery SRI, St. Petersburg; UDC621.3.035.222]

[FBIS Abstract] One of the most important problems in sealed lead-acid batteries is lowering of gas evolution. The evolution of hydrogen at the negative electrode, especially at the end of the charge cycle, and the need to utilize this gas in sealed batteries, is one of the significant features of these batteries. One way to decrease the volume of evolved hydrogen during charging is to provide an excess of active material at the negative terminal (in respect to that of the positive terminal), and for this purpose several foreign companies use lead alloy flexible lead cables. The development of electroplated coatings having high protective properties would broaden the range of application of copper leads in the fabrication of sealed lead-acid batteries. In the present work a study of the effects of copper negative leads on the characteristics of sealed lead-acid batteries demonstrated that 1) they provide an excess of active material at the negative terminal in respect to the positive, 2) they increase the capacity characteristics of the battery by increasing the amount of absorbed electrolyte in the porous structure of the electrode by virtue of the increased bulk of negative active material, and 3) they increase the efficiency of current utilization during electrode formation. Figures 2; references 8: 6 Russian, 2 Western.

Synthesis, Structure, and Biological Activity of Bovine β-Isomorphine-5 and Certain Related Peptides

957M0017 Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA—SERIYA 2 KHIMIYA in Russian Vol 35 No 3 May-Jun 94 (manuscript received 10 Sep 92) pp 278-284

[Article by S. Abd El Rakhman, A. El-Kafravi, A. Khataba, and A. Kalmush, Zagazig University, Egypt; UDC547.96]

[FBIS Abstract] Opioid peptides were isolated from the peptone of bovine casein and they were named β-casomorphines due to their morphine-like activity and origin. Bovine casomorphines differ both in chain length and aminoacid composition, although the N-terminal tripeptide structure, assumed to be important to opioid activity, is identical in all casomorphines. Recently, human β-casomorphines were isolated and found to be structurally similar to bovine casomorphine. In the present work bovine β-morphine and some sequentially close aminoacids were synthesized, including two pentapeptides and five dipeptides selected for the purpose of making them parts of a natural sequence. Data from conformational analyses were compared with results of opioid activity. The results further indicated that an analog having a looped B conformation has higher opioid activity in rats than the initial peptide. Figure 1; references 27 (Western).

Status and Developmental Prospects of Production of Monomers for Synthetic Rubber Under Free Market Conditions

957M0018A Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5 May 94 pp 11-17

[Article by S. Yu. Pavlov, Yu. I. Semin, and V. N. Churkin, "Yarsintez" Joint Stock Company; UDC661.715.352.4; 661.175.352.5; 661.715.334; 661.7:547.538.141; 661.7:547.535.151]

[FBIS Abstract] The development of market relations in Russia and the integration of synthetic rubber production into the world economy have urgently brought into question the profitability and competitiveness of monomer and synthetic rubber producers, retooling and development of monomer production. The isolated development of synthetic rubber production in Russia and the limited opportunities for importing natural rubber led to a number of significant differences with other countries in the development of the petrochemical industry. For example, demand for synthetic rubber in Russia is 94 percent compared with 65 percent for the rest of the world; that of natural rubber 6 and 35 percent. Domestic monomer production processes are both energy and labor intensive. This is especially unfortunate because research organizations, particularly "Yarsintez", have developed advanced technologies, but owing to the lack of outside competition and low energy costs, these processes have not been incorporated. The present work discusses the technical and economic evaluation of synthetic rubber production, production of butadiene, isoprene, and isobutylene. "Yarsintez" has recently developed a modified variant in hydrogenation technology as well as two processes based on the formation and subsequent decomposition of esters: reaction with n-butanol and decomposition of butyl-ter-butyl ether; preparation and decomposition of methyl-ter-butyl ether. Both of the latter processes are based on the use of so-called catalytic distillation in the presence of formed sulfo-ionite catalysts. The technologies used in Russia for production of butadiene by extraction from the C_4 pyrolysis fraction, isobutylene, styrene, and α-methylstyrene are fully competitive under free market trade conditions, and the use of existing plants for vacuum dehydrogenation of n-butane remains desirable. Existing technologies for butadiene production by two-stage dehydrogenation of n-butane and isoprene production by two-stage dehydrogenation of isopentane or by two-stage synthesis from isobutylene and formaldehyde, are not economical and require major rebuilding. Effective technical decisions have been made which will allow during the next

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1.5-3 years a rebuilding of existing technology for butadiene production by two-stage dehydrogenation of isoprene from isobutylene and formaldehyde with minimum capital investment which will provide a competitive level of butadiene and isoprene production. References 3 (Western).

Electrocracking Aqueous Solutions of Aliphatic Alcohols

957M0018B Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5 May 94 pp 18-22

[Article by O. Yu. Pesin, O. V. Yermilova, and S. M. Nosakova, Fine Chemical Technology Institute imeni M. V. Lomonosov, Moscow; UDC66.092.193:/661.721.4-661.722.2-661.725.2-661.725.4/]

[FBIS Abstract] The steadily growing significance of problems associated with preserving the environment intensified the urgency of technical solutions directed towards reducing the amount of waste material and utilizing it in some manner. One of the greatest sources of pollution is industrial plants producing oxygen-containing products where the wastes are mostly in the form of aqueous solutions. Burning these wastes requires large additional outlays of fuel resources. These solutions could also be handled by electrocracking. It has been reported in the literature that oxygen-containing compounds and hydrated hydrocarbons may be decomposed in an electrical discharge, although a systematic study has not been made. Electrocracking of these substances is also interesting from the standpoint of such secondary products as acetylene, carbon monoxide, and hydrogen which could be organized into other syntheses. It has been previously demonstrated that during electrocracking of hydrated organic oxygen-containing compounds, the process does not follow the rule of additivity. When an electrical discharge acts on a solution containing components which differ markedly in saturated vapor pressures, decomposition of the least volatile component takes place first, since decomposition precedes vaporization. In the present work a laboratory scale study was made of rules governing electrocracking of aqueous solutions of methyl, ethyl, propyl and isobutyl alcohols. The results are presented in table form. Figures 2; references 5 (Russian).

Industrial Testing of Simple Explosives Based on Porous Ammonium Nitrate

957M0018C Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5 May 94 pp 37-39

[Article by V. N. Nevskaya and V. A. Ivanov, "Akron" Joint Stock Company, Novgorod; UDC661.525.004.1]

[FBIS Abstract] In a previous work some basic explosive and physical-mechanical properties of an explosive consisting of a mixture of porous ammonium nitrate and diesel fuel were presented in comparison with similar indicators for Grammonite 79/21 and Ammonite No 6ZhV. Having a somewhat diminished heat of explosion and a larger gas volume, these explosives have almost identical values for detonation velocity, critical and pour density, work functionality, and brisance. Igdanite, prepared on-site from common saltpeter, has low physical stability (its residence time in bore holes from the moment of charging to explosion is limited to several hours). The physical stability of ammonium nitrate may be increased somewhat by partial milling or by adding coal powder or a liquid oil product (for thickening). These steps may be circumvented by substituting porous ammonium nitrate in place of granulated ammonium nitrate. In the present work some results are presented of industrial testing of porous ammonium nitrate produced at "Akron" Joint Stock Company and having a porosity exceeding 23 percent, mechanical hardness to 750 grams per granule, and absorption capacity of 5.6 percent diesel fuel. The tests demonstrated that this explosive has stable explosive characteristics on ore having average breaking strength and may be substituted for Grammonite 79/21. Figure 1; reference 1 (Russian).

Flow-Type Sensory System for Determining Cobalt in Waters

957M0022A Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 49 No 5 May 94 (manuscript received 14 May 93) pp 473-476

[Article by L. M. Trutneva, O. P. Shvoyeva, and S.B. Savvin, Geochemistry and Analytical Chemistry Institute imeni V. I. Vernadskiy, Moscow; UDC543.43:546.73]

[FBIS Abstract] The need for large scale quality control of the environment poses a problem in developing simple, sensitive, and selective automated methods for determining toxic matter. This problem may be effectively resolved by utilizing organic reagents immobilized on solid carriers, thereby combining the steps of concentrating the toxic substance in a stream (dynamic mode) with direct detection in the solid phase by spectroscopy of the diffused reflected light. Such systems are called flow-type sensory systems. In the present work a method is presented for determining cobalt in water employing a flow-type sensory system using 1-(2-pyridylazo)-2-naphthol immobilized on phosphorylated cellulose disks. The method is unique from other known methods of ion exchange colorimetry and sorption-photometry in that this method may be automated. The cobalt is concentrated in solutions of pH 5-6 in the dynamic mode on the above disks which are then treated with 0.5 M HCl. The change in coefficient of diffused reflected light is then measured at 640 nm. The method is capable of determining 2-40 micrograms of cobalt (II) in natural and potable waters. The detection limit is 0.5 microgram per liter and the method requires 15-25 minutes. Figures 3; references 16: 10 Russian, 6 Western.

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Ion Selective Electrodes Based on Polyfunctional Macroheterocyclics

957M0023A Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 49 No 7 Jul 94 (manuscript received 18 Feb 93) pp 662-675

[Article by N. G. Lukyanenko and N. Yu. Titova, Physico-Chemistry Institute imeni A. V. Bogatskiy, Odessa; UDC543.257.1:547.898]

[FBIS Abstract] Before the incorporation of macroheterocyclic compounds in the composition of ion selective electrodes (ISE), polydentate acyclic ligands were chiefly used where the differences between the stability constants of various complexes were not very great. In contrast to acyclics, the heterocyclics, as a rule, manifest sufficiently large selectivity during complex formation with metal cations that are similar in properties. This provides a good basis for developing new highly selective cation sensitive ISE. The first works on the ion selective properties of natural and synthetic macroheterocyclics and the possibility of using them as electrode components appeared in the 1970's. Coupled with the intensive growth in the chemistry of macrocyclics, the number of publications related to the study of their ion selective and complex-forming properties grew. By 1990 several thousand polyfunctional macroheterocyclics were synthesized, but only 10 percent of these compounds were tested as complex-forming ligands. In the present review an attempt is made to shed light on the status of problems as a whole, devoting special attention to an analysis of works having practical significance and having been published within the past 10 years. The review covers cation sensitive macrocyclic ISE for determining metals (cyclopolyesters), heterofunctional analogs of crown ethers, kaliksarines, bis-crown ethers, ISE for determining organic compounds, and enanthioselective ISE. Figures 60; references 115: 25 Russian, 90 Western.

Method for Determining Inorganic Anion-Inhibitors of Super Oxide Dismutase Enzyme

957M0023B Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 49 No 7 Jul 94 (manuscript received 11 May 93) pp 749-754

[Article by T. N. Shekhovtsova, A. A. Remizova, A. I. Chumakova, I. F. Dolmanova, and Yu. I. Sokolov, Moscow State University imeni M. V. Lomonosov, Moscow; UDC543:577.150.87]

[FBIS Abstract] One of the tasks in utilizing enzymatic methods of analysis is broadening the range of determinable compounds and the use of new enzymes for this purpose. In the present work an analytical application was found for the first time for the a new class of oxyreductases—super oxide dismutase (SOD). This enzyme is found in a great number of organisms: certain bacteria, fresh and sea water algae, micellar mold, higher plants, and animal and human cells. SOD plays an important role in protecting living systems. It is known that while oxygen is vital for life activity in aerobic organisms, it could also be toxic if its concentration exceeds normal in air. This is due to the formation of an active super oxide radical. SOD is a catalyst in the decomposition of this super oxide radical. In the present work some inorganic anion-inhibitors of super oxide dismutase were identified and methods were developed for determining CN^-, $S_2O_3^{2-}$, and $S_2O_8^{2-}$ anions by their inhibiting action in the catalytic activity of SOD in the autoxidation of pyrogallol. Figures 4; references 12: 7 Russian, 5 Western.

Extraction-Gas Chromatographic Analysis of Environmental Specimens

957M0023C Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 49 No 7 Jul 94 (manuscript received 22 Apr 93) pp 760-763

[Article by N. T. Karabanov, Z. P. Vetrova, T. N. Shuvalova, L. A. Ivanova, I. A. Guryev, and V. V. Kutsovskaya, Chemistry SRI at Nizhegorodskiy State University imeni N. I. Lobachevskiy; UDC543:543.54]

[FBIS Abstract] Soil contamination resulting from industrial wastes is high in the vicinity of chemical and petrochemical plants, oil pipelines, and oil storage depots. Any questions on utilizing such real estate for industrial or municipal construction are resolved after sanitary-chemical control of the level of toxicity. The purpose of the present work was to determine the composition and quantity of toxic organic compounds in extracts and gas emissions from soil samples taken along the track of the Nizhegorod subway line. Organic contaminants were extracted from the soil samples with organic solvents and their composition determined by gas chromatography. The major source of contamination was found to be aromatic compounds, namely benzene, toluene, isopropylbenzene, and diethylbenzne detected in core samples taken at ground water level. References 3 (Russian).

Acoustic Dosimetry of the Absorbed Energy of a Pulse Electron Beam

947M0024A Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 28 No 2 Mar-Apr 94 (manuscript received 5 Oct 92) pp 109-113

[Article by V.D. Kulikov, Tomsk Polytechnic University, Tomsk; UDC 537.535.5]

[FBIS Abstract] Acoustic dosimetry, which is based on the measurement of acoustic waves excited by a pulse electron beam in a solid, is among the most promising methods of obtaining information about the energy of a high-intensity electron beam that falls onto and is distributed throughout a target. An optical polarization method of registering elastic stresses was used to measure the absorbed energy of a high-intensity electron beam. The energy losses resulting from transfer of the acoustic wave were estimated, and the effect of the electric charge introduced by the beam on the transfer of energy from the beam to the target and on the distribution of energy and elastic stresses within the target's

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irradiated bulk was examined. The high-intensity electron beam used in the experiment had the following parameters: maximum electron energy, ≈0.3 MeV; current density, up to 500 A/cm^2; and pulse duration, 5-15 ns. A calorimetric sensor was used to measure the total electron beam energy falling onto the target. The experiment was set up so that light from an He-Ne laser fell normally to the side surface of the target and the plane of the light's polarization formed a 45° angle with the direction of the high-intensity electron beam's propagation. A lens located behind the target gave a magnified image of the crystal's rear face on a screen with an optical slit. An analyzer located behind the optical slit extinguished the light in the absence of elastic stresses. The elliptically polarized light exiting the crystal in the presence of elastic stresses was separated by the analyzer and registered by a photomultiplier. The time resolution equaled about 7 ns and the spatial resolution equaled 20 μm. The optical polarization method used made it possible to calculate the numerical values of the pressure in the acoustic wave. The mechanism of the acoustic wave generation was examined in different materials. In the case of alkaline metal halide crystals and quartz glass, the amplitude of the elastic stresses was a linear function of beam current density in the range from 50 to 300 A/cm^2. This finding was taken as confirmation of the proposed formula $P_T = \gamma/V$, where P_T is the thermal pressure resulting from oscillations of atoms around the equilibrium position, γ is the Gruneisen coefficient, and V stands for volume. In other words, the experiment results were interpreted as confirming the thermoelastic mechanism of acoustic wave generation. When the current density was increased by a factor of 6, the relative change in the maximum range of the electron path did not exceed 10 percent. This finding was taken as an indication that the target did not contain an electric field with an energy of 10^6 V/cm or greater. In the case of the piezoelectric semiconductor ZnSe, the effect of the electric field in the target was observed to make a marked contribution to the elastic stresses in the acoustic wave. It was concluded that in initial approximations in absorbed energy dosimetry, those losses associated with the generation of acoustic waves that constitute 10^{-2} percent of W_0 may be ignored but that the condition $\tau_u << t_a$ (where τ_u designates the duration of the electron pulse and τ_a designates the acoustic relaxation time) remains a significant factor. Figures 4; references 12: 11 Russian, 1 Western.

Study of the Viability of Photopolymerizing Composites Based on Oligocarbonate Methacrylates for the Process of Replicating Optical Information Carriers

947M0024B Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 28 No 2 Mar-Apr 94 (manuscript received 16 Nov 92) pp 182-186

[Article by R.I. Mervinskiy, L.A. Gudzovskaya, and V.Ye. Roter, Ukrainian Polygraphy Institute imeni Ivan Fedorov, Lvov; UDC 681.41:733.92]

[FBIS Abstract] Two oligocarbonate methacrylate-based photopolymerizing composites were studied to determine their feasibility for use in the process of replicating acoustic optical information carriers. The study focused on the following: the composites' viability (i.e., the time for which they can be processed without an alteration in their technological parameters) of replicating optical disks by photochemical molding, determination of a photopolymerizing composite's viability, and development of a method of monitoring the photohardening process. The first of the two composites [D-1] had OKM-2 oligocarbonate methacrylate as its primary component. The second composite [D-2] contained OKM-2 and the oligoesteracrylate MDF-2. Both composites also contained the oligomer TGM-3 as an active cross-linking component and the photoinitiator isobutyl benzoate. Specimens of D-1 and D-2 with shelf lives of 3, 144, and 306 days were studied. Their viscosity was determined by the standard methods, and their light sensitivity and the kinetics and completeness of the process of their photopolymerization under ultraviolet radiation was determined by conductometry. Three successive stages in the photopolymerization process were identified: stage 1, in which the process of photopolymerization by the oxygen of air predominates; stage 2, which entails an intensive radical process resulting in the formation of an insoluble solid polymer; and stage 3, which is a stage characterized by a sharp slowdown of the polymerization rate as the degree of conversion of the reactive double bonds of the photopolymerizing composite increased. The volume resistivity of the two systems under investigation was concluded to be linked to the mobility of their segments and macromolecules formed. The composites' viscosity and viability were found to be dictated by the same molecular mechanism, namely, reaction of the polar groups of oligomers with the oxygen of air. It was therefore concluded that either of the two characteristics may be used to determine the suitability of similar composites for use in replicating optical disks and that conductometry, which is a relatively simple and accessible testing method, could be used to estimate the light sensitivity of photopolymerizing polymers and the kinetics and completeness of the process of photopolymerization based on changes in their volume resistivity [R_V]. Conductometric studies of the two photopolymerizing composites established that D-1 remains stable for at least 10 months whereas the light sensitivity of D-2 decreases significantly and its induction period nearly doubles after 306 days of storage. The difference in the shelf lives of the composites D-1 and D-2 was attributed to the high initial viscosity of the MDF-2 used in the D-2 and to its tendency to form associates upon exposure to the oxygen of air and moisture. Both composites were nevertheless deemed feasible for use in making copies of optical disks by the method of photochemical molding. D-2 was recommended for use in situations where disks would be stored for less than half a year, and D-1 was recommended for use in situations involving longer storage periods. Figures 3; references 13: 12 Russian, 1 Western.

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New Superconducting Mercury-Based Complex Cuprates

947M0025A Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 39 No 10 Oct 94 (manuscript received 26 Apr 94) pp 1755-1757

[Article by G.M. Kuzmicheva, Ye.P. Khlybov, L.N. Bogacheva, V.N. Kochetkov, and I.N. Afanasyeva, Moscow State Academy of Fine Chemical Technology imeni M.V. Lomonosov and High-Pressure Physics Institute, Russian Academy of Sciences, Troitsk; UDC 548.51,621.317.33]

[FBIS Abstract] A homologous series of mercury-based phases, i.e., $HgSr_2Ca_{n-1}O_{2n+2+\delta}$ were synthesized and studied. The samples were synthesized in two stages: solid-phase sintering of the components without mercury oxide under normal conditions and annealing of a mixture of the resultant matrix with mercuric oxide under high pressure. Grade "R-O" rare earth metal oxides and analysis-grade oxides of copper and strontium carbonate served as the starting materials. The starting mixtures were milled, pressed into tables (8-10 mm in diameter and 2-3 mm high), and annealed in air at a temperature of 960°C for 6 hours. The resultant matrix was milled; mercuric oxide was added in the required ratio; and the mixture was milled once again, pressed into tablets (3 mm in diameter and 3-4 mm high), and processed at a temperature of 750-950°C and pressure of 4-7 GPa for between 5 minutes and 1 hour in a "doughnut"-type high-pressure chamber. Diffractometry and qualitative and quantitative x-ray phase analysis established that the resultant complex cuprates were multiphase materials whose phase compositions contained the homologous series $HgSr_2(Ln, Ce)_{n-1}Cu_nO_{2n+2+\delta}$ with n = 1-3 for Ln = La and n = 2 for Ln = Sm (limiting boundary *Pmmm*). The multiphase specimens were designated 1201, 1212, 1223. The phase 1212 was determined to have the structure $HgSr_2(Ln, Ce)Cu_2O_{6+\delta}$ and a critical temperature [T_c] of approximately 40 K. Its Hg-O bond was directed along the crystallographic direction (110). A second superconducting phase (designated 1212*) with a T_c of 26 K, the probable structure $(Hg,Cu)Sr_2LaCu_2O_{6+\delta}$, and its (Hg,Cu)-O bond along the (100) crystallographic direction was identified. A third superconducting phase (designated 1212**) with a T_c of 80 K was obtained by changing the starting mixture to $HgSr_2(Ca_{0.5}La_{0.3}Ce_{0.2})Cu_2O_x$ and thereby turning the Hg-O or (Hg,Cu)-O bond so that it was directed along the (hk0) crystallographic direction. In several studies of the newly obtained specimens, a sharp drop in electric resistance was observed at a temperature of about 190-240 K with a width of $\Delta T \approx 10$-15 K. This effect proved reproducible for a day, after which it disappeared completely. The observed phenomenon was analogous to that reported by Tholence et al. for the system Hg-Ba-Ca-Cu-O and was said to possibly be linked to filamentary superconductivity. Figures 3, table 1; references 21: 7 Russian, 14 Western.

Molecular Ordered Structures on Solid Surfaces

947M0026A Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 29 No 4 Jul-Aug 93 (manuscript received 25 Oct 93) pp 291-305

[Article by B.A. Nesterenko and A.V. Nabok, Semiconductor Physics Institute, Ukrainian Academy of Sciences, Kiev; UDC 539.216.2]

[FBIS Abstract] The problems in creating perfect and two-dimensionally ordered Langmuir-Blodgett film were considered in a study focusing on the role of the physicochemical state of the semiconductor substrate in the formation of the planar structure of Langmuir-Blodgett layers. The method of low-energy electron diffraction was used to record the hexagonal structure of a bilayer of stearic acid on an atomically pure surface (111) of $Cd_xHg_{1-x}Te$ (x = 0, 2) semiconductor. Low-energy electron diffraction patterns were observed both from the surface of the very substrate and from the C_{18} bilayer on it. A model of the formation of Langmuir-Blodgett films was proposed on the basis of an analysis of the low-energy electron diffraction studies. According to the model, the presence of atomic terraces with a (112) orientation on the (111) face of $Cd_xHg_{1-x}Te$ is the factor most likely responsible for the two-dimensional ordering of the first layer of C_{18}. The terraces may orient the C_{18} molecules during the process of transfer of the monolayer to the substrate, resulting in complete rearrangement of the monolayer's domain structure and the formation of a new C_{18} domain structure with a predominant orientation. The second C_{18} layer repeats the structure of the first inasmuch as it is transferred in a mode of epitaxy on account of the interaction between the COOH groups of C_{18} molecules and the formation of cyclic dimers with hydrogen bonds. Langmuir-Blodgett films were produced from selected amphiphilic phthalocyanine derivatives (4R-PcM, where M = Cu or VO), and the relationship between their structure and electrical and optical properties was examined. Planar optical dichroism relative to the direction of pulling during the Langmuir-Blodgett process was observed in the $4R_2PcCu$ Langmuir-Blodgett films. The dichroic ratio was determined to equal 2.5-3. The 4_2PcCu Langmuir-Blodgett films were found to possess strong conduction anisotropy, and their planar conduction was determined to be six orders of magnitude higher than their lateral conduction. Measurements of the 4_2PcCu indicated that holes were their current carriers, and measurements of the temperature dependence of their conduction confirmed the semiconductor nature of their planar conduction. The possibility of using various substituent hydrocarbons to purposively modify the optical characteristics and electric conduction of phthalocyanine Langmuir-Blodgett films was confirmed. Because further tests established that other electron acceptor impurities, including nitrogen oxides, can affect the electric conduction of 4_2PcCu Langmuir-Blodgett films, they were used as the basis for a sensor that detects rather low concentrations of nitrogen oxides in the atmosphere. The sensor

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is most sensitive and responsive at a temperature of 150°C because that is when NO_x adsorption and desorption processes are equalized. In tests conducted at 150°C, the new sensor was capable of detecting NO_x in concentrations ranging from 0.1 to 1,000 ppm. Figures 13, table 1; references 34: 10 Russian, 24 Western.

Development of Ecologically Pure Technologies for Kyrgyzstan's Gold Mining Industry

947M0027A Novosibirsk KHIMIYA V INTERESAKH USTOYCHIVOGO RAZVITIYA in Russian Vol 1 No 3 Dec 93 pp 317-322

[Article by B. Imanakunov, S. Osmonaliyeva, L. Lukina, and Kh. Malayeva, Inorganic and Physical Chemistry Institute, Republic of Kyrgyzstan Academy of Sciences, Bishkek]

[FBIS Abstract] Biogeotechnology is the science of using microorganisms and their metabolism products to extract metals from ores, ore concentrates, rock, and solutions. Biogeotechnology and processes of the biologic sorption of metals from solutions are both promising from the standpoint of the development of ecologically pure gold mining processes suited to the conditions existing in Kyrgyzstan. In about 30 percent of Kyrgyz ore, gold and polymetals are present in a dispersed-colloidal state necessitating the creation of special extraction processes. Cyanide-based gold extraction processes are not suitable for use in Kyrgyzstan because one of the republic's largest gold deposits is located within the Lake Ysyk-Kol resort area. Research directed toward developing a biogeotechnological process to extract gold and neutralize the sewage generated by Kyrgyzstan's gold extraction enterprises has been under way since 1988. The said research has focused on the following topics: 1) the possibility of using the method of bioflotation extraction of finely dispersed gold from gold-bearing ore and 2) development of a process for biodestruction of the cyanides present in sewage generated by gold recovery enterprises. During the research focusing on bioflotation-based extraction, scientists from Kyrgyzstan's Inorganic and Physical Chemistry Institute, the Natural Disperse Systems Department of the Ukrainian Academy of Sciences, and the Kyrgyzgeologiya Production Association tested a bioflotation process in which bacterial cells were used to extract gold from gold-bearing ore samples collected in Kyrgyzstan. The proposed process resulted in a 10-12 percent increase in the amount of gold extracted and in a significant reduction in the amount of gold left in tailings (up to 0.2 g/metric ton). In the research focusing on biodestruction of cyanides, scientists adapted a set of bacterial strains to cyanide-containing sewage generated by the Makmal Gold Extraction Plant, which uses the accepted cyanide-based gold extraction process and subsequent recovery of cyanides by the ecologically damaging hypochloride method. The most active of the microorganisms tested under conditions of aeration at temperatures of 10-25°C and pH levels of 9-10 neutralized 95-98 percent of the cyanide present in model reactions and 90-95 percent of the cyanide present in actual pulp from the extraction plant. In large-scale tests conducted at the plant, the most effective microorganism reduced the amount of cyanides present in the plant's tailings from 15.6 to 0.02 mg/l after 5 days. Figures 4, table 1; references 5 (Russian).

Effective Ecologically Clean Processes in the Paper and Pulp Industry

947M0027B Novosibirsk KHIMIYA V INTERESAKH USTOYCHIVOGO RAZVITIYA in Russian Vol 1 No 3 Dec 93 pp 323-330

[Article by A.I. Mikhaylov, L.D. Kaplun, S.I. Kuzina, S.V. Demidov, Yu.A. Filonenko, A.V. Beygelman, A.V. Burov, M.A. Zilbergleyt, and L.I. Galov, Chemical Physics Institute, Russian Academy of Sciences, Chernogolovka, Moscow Oblast]

[FBIS Abstract] Before scientifically effective, scientifically substantiated, and ecologically sound technologies and processes for the paper and pulp industry can be created, basic research on physicochemical processes at the molecular, submolecular, and structural dynamics levels is needed. Consequently, the production and modification of wood components were examined from the standpoint of solid-state physical chemistry. Specifically, a set of ecologically sound wood delignification processes, including methods based on oxidation and solvolysis, cellulose bleaching, and production of wood pulp and new materials based on cellulose and lignin, were examined within the framework of the Russian national scientific-technical program "Chemistry and Ecologically Safe Technology for Processing Renewable Plant Material." Polychronic kinetic algorithms were developed that made it possible to adequately describe the kinetics of delignification and that may therefore be used as a basis for creating a computer kinetic model that can in turn be used to optimize and control cooking times and temperatures all the way to residual lignin contents as low as 3-5 percent. One major finding of the research on delignification kinetics was that preliminary radiation-chemical modification of wood reduces the required cooking time for pine in organic solvent by a factor of 1.5-2. The research on processes of oxidation and electron transport during the chemical processing of wood and its components established that the selectivity of destruction of the ether bond in the quinomethide reaction center of the lignocarbohydrate complex is the result of a sharp decrease in the energy needed to [illegible] the C-O-C bond on account of the energy of stabiliz[illegible] of the resultant free-radical products. The research [illegible] firmed the importance of processes associated with transport of an electron whose injection into a structural fragment of lignin results in the formation of stable destruction products. The said research also established that the OH^-- and S^--type ions in alkaline (including sulfate) cooking and the $RCOO^-$- and RO^--type ions in cooking involving organic solvents (alcohol, acetic acid,

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etc.) are sources of such electrons in the oxidation occurring during delignification. The studies directed toward improving the ecological safety of chlorine bleaching of cellulose revealed the following two ways of increasing the selectivity of chlorination of lignin and thereby suppressing the formation of toxic compounds: lowering the temperature at which cellulose intermediate products are bleached to approximately 0°C and reducing the reactivity of the active reaction centers by using Cl_2^- ion radicals instead of Cl atoms, which are more active. A formula for oxidative-solvolysis delignification based on organic solvents such as alcohols and carbonic acids without the use of mineral reagents was proposed that makes it possible to increase cellulose yields and reduce cooking times by a factor of 1.5-2.0. The said process reduces consumption of fresh water to 5-7 m^3/metric ton of cellulose instead of the 100-200 m^3/metric ton required by the existing process and reduces capital expenditures by 25 percent. Figures 6, table 1; references 5: 3 Russian, 2 Western.

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More Precise Determination of Influence of Eruptive Volcanism on Climate

957N0031A St. Petersburg VESTNIK SANKT-PETERBURGSKOGO UNIVERSITETA: GEOLOGIYA, GEOGRAFIYA in Russian Vol 2 No 14 Jun 94 (manuscript received 18 Jan 94) pp 46-60

[Article by O. A. Drozdov and I. V. Malkova, St. Petersburg University; UDC 551.553.7]

[FBIS Abstract] The climatic effects (especially subsequent temperature decrease) of volcanic eruptions are reviewed with a breakdown of their location into three latitude zones (0-30, 30-60, 60-90°). The amplitudes of variation of annual temperature over a 107-year period under the influence of natural and anthropogenic factors in these three zones were taken into account as the background for analyzing these effects. Improvements in observation techniques over the passing decades (most recently, introduction of lidar observations of stratospheric aerosol) must be factored into the weighted evaluation. There is much more to an analysis of eruption-induced climatic phenomena than has been suggested by other authors. A great many factors complicating the picture are examined in detail because some phenomena attributed to volcanic eruptions might well be caused by other conditions. It is preferable to examine eruptions in series, rather than as individual events. A detailed study was made of how volcanic eruptions exert an influence on interlatitudinal temperature contrasts, having direct importance for winter (and in part, summer as well) moistening in the middle latitudes. Four series of eruptions were analyzed: that beginning with the Krakatau eruption; that initiated by the eruptions of Caribbean volcanoes in 1902; eruptions of 1945-1953; the series beginning with the eruption of Agung in 1963; eruptions of 1979-1982. These series reveal that changes in interlatitudinal contrasts and the related winter moistening of volcanogenic origin are traced for up to 7 years, but sometimes are manifested only 4-6 years after an eruption. A decrease in interlatitudinal temperature contrasts most frequently arises in the first year after a low-latitude eruption when turbidity for one reason or another has not been reflected in the temperature of the higher latitudes and sometimes such conditions prevail for several years in a row. In general, all eruptions causing a hemispheric cooling of about 0.3-0.5° gave rise to short or prolonged temperature contrast increases. References 16: 14 Russian, 2 Western.

Ecologic Normalization of State and Anthropogenic Impacts on Natural Ecosystems

957N0031B St. Petersburg VESTNIK SANKT-PETERBURGSKOGO UNIVERSITETA: GEOLOGIYA, GEOGRAFIYA in Russian Vol 2 No 14 Jun 94 (manuscript received 24 Aug 93) pp 60-69

[Article by V. V. Dmitriyev, St. Petersburg University; UDC 577.4:502.7.001.5(043.2)]

[FBIS Abstract] The different possible definitions of "ecologic normalization" are given and ways to solve the normalization problem used in the past and at the present time are outlined. The deficiencies in these approaches are stressed. For example, in normalization no allowance is made for the prehistory associated with accumulation of pollutants in the medium. There are no reliable forms of monitoring for discharged pollutants. For many pollutants there are no monitoring methods guaranteeing sufficient accuracy, sensitivity and reproducibility of the results and procedures for ecologic-toxologic screening of ecosystems have not been developed. The MAC (maximum admissible concentration) system does not guarantee the preservation of natural objects as intact ecosystems. In validating an MAC no allowance is made for the different trophic status of ecosystems and the seasonal characteristics of natural factors against whose background the toxicity of pollutants is manifested. The role played by biotesting and bioindication is reviewed. It is stressed that in regulations pertaining to use of natural resources there is no index which in integral form characterizes the toxic properties of the medium. Various proposed indices are discussed and use of the ecologic safety index is illustrated as a specific example. The applicability of such indices for aqueous ecosystems is described in detail. Some of the promising directions in evaluating the anthropogenic impact on water bodies are examined. Usually such indices do not take into account the intensity and response of the ecosystem as a whole to such loads, although prediction of the reaction of ecosystems to different types of anthropogenic loads is the principal objective of ecologic normalization. Combined ecologic indices are possible for reflecting ecosystem response to anthropogenic impacts. They also can be used for evaluating the transition of an ecosystem through a critical state. Figure 1; references: 16 Russian.

Laser Beam Propagation in Stratosphere

957N0032A Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 10 Oct 94 (manuscript received 12 May 94) pp 1357-1370

[Article by V. A. Banakh and N. N. Smalikho, Atmospheric Optics Institute, Siberian Department, Russian Academy of Sciences, Tomsk; UDC 551.593.13]

[FBIS Abstract] Estimates are made of the dispersion of random displacements and the mean intensity of a laser beam propagating on horizontal and slightly sloping stratospheric paths. On the basis of the vertical spectrum of fluctuations of the refractive index generalized for the entire considered frequency range formulas are derived for the dispersions of lateral displacements and the dispersion of fluctuations of beam phase front curvature. The dispersion of the vertical displacements is determined primarily by inhomogeneities of the refractive index with one specific size, whereas the dispersion of fluctuations of beam phase front curvature is determined by inhomogeneities of a different size. Both these parameters are essentially dependent on the zenith angle α of

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the direction of propagation as a result of strong anisotropy of fluctuations of the refractive index and atmospheric sphericity. The amplitude of vertical random beam displacements is two orders of magnitude less than the regular beam deflection but approximately two orders of magnitude greater than the amplitude of the horizontal random displacements. On extended paths (more than 500 km) defocusing of the focused laser beam by random inhomogeneities is more significant than the defocusing caused by regular variations of the stratospheric refractive index. In such a case the intensity on the axis of the focused beam drops by a factor of 2 or more in comparison with the diffracted beam under the condition $\alpha \geq 90°$ and $\Omega \geq 10$. Figures 2; references 22: 19 Russian, 3 Western.

Shipborne Hydrolidar Outfit for Sounding Upper Oceanic Layer

957N0032B Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 10 Oct 94 (manuscript received 6 Apr 94) pp 1403-1409

[Article by O. A. Kukin, V. I. Ilichev, A. Yu. Mayor, A. N. Pavlov, A. G. Stafiyevskiy and V. A. Tyankin, Pacific Ocean Oceanological Institute, Far Eastern Department, Russian Academy of Sciences, Vladivostok; UDC 551.46.07]

[FBIS Abstract] A hydrolidar for sounding the upper layer of the ocean (ULO) while a ship is proceeding on course at a normal speed, installed in the ship's hydrooptic shaft, was developed and used aboard the Akademik Lavrentyev. Previous designs could be used only when the shift was drifting or proceeding only at a very low speed, greatly restricting expeditionary observations. A block diagram of the new hydrolidar is given and its structure and functioning are described in detail. The principal technical specifications are: radiation wavelength—532 nm; pulse power—180 mJ; pulse duration—10 ns; frequency of laser pulse trains—up to 12 Hz; objective diameter—300 mm; number of registry channels—2; minimum depth resolution—1.2 m. The results illustrate the superiority of this new shipboard hydrolidar system. The space-time structure c(h,t) retrieved using it can be applied in studying the processes transpiring in the upper layer of the ocean (currents, frontal zones, internal waves, etc.). The limiting depth of c(h,t) retrieval was about 80 m; the depth was limited by the absence of reliable algorithms for computing the coefficient of laser radiation extinction for such optical depths. The functioning of the hydrolidar outfit and the method for display of collected information in many respects are similar to that characteristic for acoustic sounding systems. It is therefore much easier to carry out a correlation analysis of data collected with simultaneous sounding in the acoustic and optical ranges. Such work to a considerable degree may remove that uncertainty which exists in the identification of processes occurring in the ULO. Figures 2; references: 4 Russian.

Monitoring Atmospheric Pollution Using Differential Absorption Lidar in IR Spectral Range

957N0032C Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 10 Oct 94 (manuscript received 28 Mar 94) pp 1410-1414

[Article by V. A. Gorodnichev and V. N. Kozintsev, Electronics and Laser Technology Scientific Research Institute; Moscow State Technical University imeni N. E. Bauman; UDC 621.373.826]

[FBIS Abstract] In situ tests were carried out of a differential absorption lidar based on a parametric light oscillator (PLO) with a CdSe crystal smoothly tunable in the spectral range 8-13 μm. An optical diagram of the instrument is given. The lidar transmitter includes two tunable PLO. At the output of each of the laser transmitter channels there is a Gregory correcting telescopic system consisting of two spherical reflecting mirrors with an aluminized coating. Using such optical systems the divergence of laser radiation of each of the channels was reduced from 3 to 0.3 mrad. The lidar optical system, transmitter and receiver, was mounted on a single rotating platform making possible rapid and precise change in the sounding direction in the azimuthal range +/-180° and 45° in angle of elevation. A cell was used in the measurements. The gas concentration in the cell was determined before and after the experiment by the photoelectrocolorimetric method. Spectral measurements were made at a pressure 1 atm. The transmission spectra of hydrazine, unsymmetric dimethyl hydrazine, tetramethyl tetrazene and NH_3 were measured. The measured absorption indices are tabulated for different sounding wavelengths. Five series of measurements were made (50 measurements each). Results of lidar measurements and determinations made by the chemical method are compared and discrepancies are explained. Figures 4; references 3: 2 Russian, 1 Western.

Effect of Wind Speed Fluctuations on the Space-Time Structure of Lidar Aerosol Signals

957N0033 Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 9 Sep 94 (manuscript received 3 0 Mar 94) pp 1228-1232

[Article by A. A. Afanasyev, G. Ya. Patrushev, Institute of Atmospheric Optics, Siberian Division Russian Academy of Sciences, Tomsk; UDC 551.501.8]

[FBIS Abstract] The presence of spatial anisotropy of wind speed fluctuations (in the vertical and horizontal components of wind speed) has a noticeable effect on the form of correlation functions for lidar signals. A decrease in the coherence of wind speed fluctuation leads to a substantial change in the slope of the phase spectrum. This is an analytical study of the effect of wind speed fluctuations on the characteristics of aerosol lidar signal fluctuations. Spatial anisotropy of wind speed over time

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and over the spectrum is considered. Anisotropy parameters are determined by atmospheric stratification. Variations in the strength of the echo signal are due to fluctuations in the concentration of particles in the scattering volume. When there are strong wind speed fluctuations, the phase spectrum becomes nonlinear. A normalized space-time correlation function is derived in spherical coordinates for backscattered radiation. The use of coherent analysis is noted and the effect of wind speed fluctuations in this method of analysis are discussed. Figures 2; references 5: 4 Russian, 1 Western.

Optical Sensing of the Combustion Products of a Solid-Fuel Model Motor

957N0034A Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 8 Aug 94 (manuscript received 9 Mar 94) pp 1127-1131

[Article by S. S. Vorontsov, A. M. Orishich, A. P. Petrov, V. N. Snytnikov, Institute of Theoretical and Applied Mechanics, Siberian Division Russian Academy of Sciences, Novosibirsk; UDC 53.082.52/53+53.087.4]

[FBIS Abstract] The exhaust of a solid-fuel model motor is illuminated by a laser beam (He-Ne or CO_2) near the jet mouth at three wavelengths (630, 3390, and 10600 nm) to evaluate the size, concentration, total mass, and total surface of aerosol particles per unit volume. The optical system is described and a schematic provided. At small distances from the jet mouth the spectrum of the plume in the visible range (0.3-0.7 μm) is close to an equilibrium continuous spectrum, with the exception of isolated Na resonant lines. The continuous spectrum is due to the presence of solid-state emissions outside the absorption bands. The presence of ecologically dangerous CO and HCl in the plume far from the jet mouth was found with an optical-mechanical scanning IR system scanning at 4800 nm for CO and 3500 nm for HCl. Values more than a factor of ten larger than the values as sociated with equilibrium spectrum were found far from the jet mouth in individual lines of the molecular spectrum. It is found that interaction with microparticles is responsible for absorption of radiation as wavelength decreases. The results show the value of using optical methods to study and monitor gas plasma streams. Figures 4; table 1; references 2 (Russian).

Raman Lidar Detection Range for Trace Atmospheric Pollutants in the UV "Solar Blind" Region

957N0034B Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 8 Aug 94 (manuscript received 28 Mar 94) pp 1132-1138

[Article by Yu. F. Arshinov, S. M. Bobrovnikov, A. G. Popov, D. I. Shelefontyuk, V. K. Shumskiy, Institute of Atmospheric Optics, Siberian Division Russian Academy of Sciences, Tomsk; UDC 551.501]

[FBIS Abstract] Raman lidar is used to detect gaseous pollutant emissions in the UV range. The problems associated with using this type of monitoring system in daylight can be avoided by operating lidar in the "solar-blind" region of the spectrum, that is, where solar radiation is absorbed by the ozone layer. However, tropospheric ozone and oxygen remain a problem. The coefficient of extinction was calculated at 200-320 nm for the main attenuating components of the troposphere using experimental data on absorption cross sections for O_2 and O_3 and the cross section of molecular scattering. The region above 265 nm has a smooth decrease in extinction down to values characteristic of molecular scattering. In the "solar blind" region (200-290 nm) there is a strong spectral dependence of detection range for fixed concentrations of pollutant gas. Nume rical studies of the detection range using Raman lidar showed that the solar-blind region is a relative interval that must be determined individually for each atmospheric component. A frequency close to the "red limit" should be used in sounding to minimize absorption by tropospheric ozone. Figures 6; references 5 (Russian).

Dynamics of Physical-Chemical Parameters of Urban Aerosol During Cold Front Passage

957N0034C Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 8 Aug 94 (manuscript received 4 May 94) pp 1149-1153

[Article by A. Ye. Kaplinskiy, I. A. Sutorikhin, Institute of Marine and Ecological Problems, Siberian Division Russian Academy of Sciences, Barnaul; UDC 551.510.42]

[FBIS Abstract] Data is presented on the daily pattern of the counted concentration of aerosol particles over Gorno-Altaysk, as well as the mass concentration of a number of chemical elements in the particles. This city is in a valley subject to inversion conditions. The situation is exacerbated by the presence of over 100 small boiler flues without scrubbing systems and the use of low-grade coal for heating. At the beginning of measurement, there were calm conditions and no snow cover. The total concentration of aerosols decreased overnight, increased as the day began, and reached a maximum at 11AM local time. In the second half of the study, a cold front passed through accompanied by snowfall and an increase in wind speed. As the front passed through, aerosol was scattered and partially washed out of the atmosphere, reducing the concentration by two orders of magnitude. The size distribution of particles changed very little because the wind could not clear out the air completely. Rather, there was an equalizing of aerosol concentration over the area of the city. Cr, Be, Ba, Zn, Cu, and Cd levels all increased after daybreak and were reduced to varying degrees by the passage of the cold front. The absolute concentrations of all elements studied did not exceed the maximum permissible concentration; however, Pb, Cd, Mn, and Zn concentrations were all a factor of 4-6 higher than the maximum background value for the European part of Russia. Figure 1; table 1; references 2 (Russian).

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Lidar Study of Aerosol Concentration Fluctuations at Earth's Surface

957N0035A Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 9 Sep 94 (manuscript received 15 Mar 94) pp 960-966

[Article by Yu. S. Balin, I. A. Pazenkov, A. P. Rostov, Institute of Atmospheric Optics, Siberian Division Russian Academy of Sciences, Tomsk; UDC 555.521.3]

[FBIS Abstract] The Monin-Obukhov similarity theory is used to obtain an initial semi-quantitative approximation of a universal function for the dispersion of fluctuations of aerosol concentration using a parameter which characterizes the hydrodynamic state of the atmosphere. The parameter used to characterize the fluctuations in concentration is the backscatter coefficient. The Richardson number, which is usually used, is considered to be zero or near zero. Experimental lidar and UV acoustic anemometer data are analyzed. Analysis of experimental data revealed no unive rsal relation between physical atmospheric parameters. Neither is there a relation between fluctuations in the backscatter coefficient and the Richardson number, except when there is scale normalization of the fluctuations. In this case the relation ship is described by a hyperbolic function. Figures 6; references 10: 9 Russian, 1 Western.

Cloud Cover Sounding With an Orbital Laser Range Finder

957N 0035B Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 9 Sep 94 (manuscript received 16 Apr 94) pp 967-975

[Article by G. P. Kokhanenko, G. G. Matviyenko, V. S. Shamanayev, Yu. N. Grachev, I. V. Znamenskiy, Institute of Atmospheric Optics, Siberian Division Russian Academy of Sciences, Tomsk; UDC 551.501]

[FBIS Abstract] The possibility of using orbital lidar to sound cloud cover is explored by interpreting signals obtained from geodesic laser range finders. There is a description of the method used to reconstruct the optical characteristics of cloud cover from the measured length of the echo signal at several energy levels. The probabilities of detecting several values of the coefficient of extinction and the lidar ratio obtained from the authors' estimates are compared with published data. The results that are obtained are consistent with cloud physics. It is possible to obtain reliable information on cloud layers using range finders. Suggestions are offered on fine-tuning the specifications of the equipment (using an amplitude-time recording system instead of the threshold system used in this paper) and improving the information processing algorithms. Figures 4; table 1; references 10: 5 Russian, 5 Western.

Autodyne Pulsed and CW Lidar Using Nd-YAG Lasers

957N0035C Tomsk OPTIKA ATMOSFERY I OKEANA in Russian Vol 7 No 9 Sep 94 (manuscript received 15 Nov 93) pp 994-997

[Article by Ye. P. Gordov, G. G. Matviyenko, V. S. Rybalko, V. A. Sennikov, A. V. Khachaturyan, V. G. Khachaturyan, Institute of Atmospheric Optics, Siberian Division Russian Academy of Sciences, Tomsk; UDC 535:621.375]

[FBIS Abstract] A system of optically coupled pulsed and CW Nd-YAG lasers are used as an autodyne lidar device. Specifications are given. The behavior of echo signal intensity is studied when the echo signal is injected into the CW laser in various operating modes. Three operating modes are examined: only the pulsed laser in operation, the pulsed and CW laser in operation with the CW laser in pre-threshold generation mode, and with the CW laser in generation mode. Oscillographs of signals and echo signals are presented for each mode. The CW laser in pre-threshold mode is a good amplifier. These lasers are found to be highly sensitive to the echo signal injected into the autodyne lidar device. This design may be used to construct an experimental high-sensitivity atmospheric spectrometer. Figures 5; references 7: 3 Russian, 4 Western.

New Method To Prepare Initial Information for Long-Term Weather Forecasting

957A0077 Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 11 Nov 94 (manuscript received 30 May 94) pp 100-109

[Article by A. N. Bagrov, Ye. A. Loktionova, State Scientific Research Center, Russian Federation; UDC 551.501.724/75:5 51.509.22]

[FBIS Abstract] This paper proposes a new automated method to prepare initial information for long-term weather forecasting. The synoptic-statistical method is used to calculate average ten-day and monthly air temperature, pressure at sea level, and precipitation totals. Data is gathered directly from stations that have 4-8 observation periods per day. This is a change from the previous system (CLIMAT), where local data was transmitted to regional centers that calculated averages and then transmitted that information to the main processing center. The old method was plagued by errors and delays. Mapping and calculation of deviations had been done manually at the main processing center. This new system, which went into operation in January 1994, has proven to be an adequate replacement for the CLIMAT system, which itself was modified in November 1994. Values obtained using the old and new systems are compared in a table. The algorithm is described, as is the new automated mapping system. There are some blank spots in maps for Eastern Siberia and the Far East because some stations in these areas do not transmit meteorological reports on a regular basis. Figures 3; table 1; references 7 (Russian).

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Petergof Genetic Collections of Microorganisms

957C0018A Moscow GENETIKA in Russian Vol 30 No 9 Aug 94 (manuscript received 10 Mar 94) pp 1123-1129

[Article by M.G. Samsonova, V.M. Andrianova, T.N. Borshchevskaya, and A.S. Chunayev, Genetics and Selection Department, Saint Petersburg State University, Saint Petersburg; UDC 579.864:575.23:582.64:681.3.06]

[FBIS Abstract] The Petergof Genetic Collections are extensive collections of genetically modified yeasts and microalgae. The collections were created in the 1960s during a study of the laws governing mutation processes and have been housed at the Genetics and Selection Department of Saint Petersburg State University since their creation. The yeast collection contains approximately 1,000 genetically marked strains of *Saccharomyces cerevisiae* and *Pichia methanolica* that are stored in a nonmetabolizing state by means of a simple technique that does not require any special training and that may be used at any microbiology laboratory. The yeasts are marked with various mutations, including auxotrophicity, suppressor mutations, and mutations altering colony morphology. The origin of each specimen in the Petergof yeast collection is documented from the time when the specimen was a single diploid cell. The original yeast collection has been expanded to include specimens isolated by various Russian and foreign researchers. The Petergof microalgae collection contains approximately 600 strains of the genera *Chlorella*, *Scenedesmus*, and *Chlamydomonas*, including more than 500 strains of *Chlamydomonas reinhardtii*, as well as the strains*Chlorella vulgaris*, and *Scenedesmus obliquus*. Eighty strains of *Chlorella* and 20 strains of *Scenedesmus* are pigment mutants and their revertants, and the *Chlorella* collection includes 50 "feeder" strains. Initially, catalogue information regarding the collection was recorded in handwritten journals. The first catalog of the collection was published in 1972, and card file of catalog information was developed in the beginning of the 1980s. The first catalog of the collection's yeast strains was published in 1988. A revised and expanded version of the catalog is being developed in English. A data bank characterizing the collection's strains has been created at the Genetics and Selection Department based on the GENESTRAIN database manager in the language Clipper (5.0) for IBM-compatible computers. The data bank consists of three program files and three database files with a common index key. A graphic interface for the database that contains information regarding selection of *Ch. reinhardtii* strains and crosses that have been performed has been developed in the HyperCard operating system. The Petergof collections are used in the curriculum at the Genetics and Selection Department to demonstrate the parallelism of homological series of hereditary variability among green algae and in practicums in the fields of cellular and molecular plant biology. The Petergof collection's strains are also used extensively in basic and applied research in many laboratories in Russia, the CIS countries, and abroad. Figures 4; references 36: 21 Russian, 15 Western.

Visible Photoluminescence of Plants

947C0526D St-Petersburg PISMA V ZHURNAL TEKHNICHESKOY Fiziki in Russian (manuscript received 25 Apr 94) Vol 20 No 13 Jul 94 pp 56-59

[Article by VV.Kh. Shpunt and Yu.V. Rud; Physicotechnical Insitute imeni A.F. Ioffe, Saint Petersburg]

[FBIS Abstract] A study of photoluminescence was performed on green leaves of Allium sativum L. and on green leaves and petals of the flower Calendula officinalis L. Radiation from an ILA-120 ragon laser served as a source of photoexcitation. Some regularities of photoluminescence in human skin and plant leaves were noted. In human skin, radiation dominated in the 2.1-2.5 eV regions but, in plant leaves, it shifted to the long-wave region and was localized in a narrowing range of energies from 1.6-1.8 eV at 3000 degrees K. The quantum effectiveness of radiation transitions in the green leaves was high. The features of photoluminescence observed were considered to be important not only for doctors and biologists but may also be useful in the search for materials of biological origin for needs of optoelectonics. Figures 2; references 5 Russian.

Immunocytochemical Analysis of Hormonal Status of Animals Transgenic for Growth Factor Genes and for Mini-Gene of Human Growth Hormone Releasing Factor

947C0527A St. Petersburg TSITOLOGIYA in Russian (manuscript received 30 Jun 93)VOL 36 No 4 Apr 94 pp 372-377

[Article by V. K. Kazakov, S. Rosokhatskiy, T. V. Ignat'yeva, G. F. Golinskiy and A. F. Smirnov; All-Russian Institute of Genetics and Farm Animal Breeding, St. Petersburg-Pushkin; Institute of Genetics and Animal Breeding, Polish Acadeny of Sciences, Warsaw; Institute of Experimental Medicine, Russian Academy of Sciences, St. Petersburg

[FBIS Abstract] Immunocytochemical analysis of the hormonal status of rats, transgenic for the gene of the human growth hormone was described and discussed. Amplification of synthesis of endogeneous growth hormone in somotropes of the hypophysis was demonstrated by the use of polyclonal and monoclonal antibodies. Activity of the allogenic growth hormone gene did not appear in tissue in which this might be expected according to the specifics of MT1 and TAT promotors (liver, kidney, pancreas). Transgenic animals of some generations (F_0, F_1, F_2) showed disturbance of functional morphology of glucagon and insulin-producing cells and an inflammational process in the islets of Langerhans. The transgenic rabbits and swine with the gene of releasing factor of human growth hormone did

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not show any severe disturbance. Pathological changes appeared in the glucagon-producing cells of the pancreas and in the morphology of the rabbit stomach tissue. The data were discussed in connection with general problems of transgenic activity and its interaction with an endogenous homolog. References 29: 3 Russian; 26 Western.

Reduction of Fluctuating Asymmetry in House Mice in Territories Contaminated by Chemical and Radioactive Mutagens

957C0045A Yekaterinburg EKOLOGIYA in Russian No 3 May-Jun 94 pp 94-97

[Article by E.A. Gileva and N.L. Kosareva; UDC 504.054:575.224:599.323.4]

[FBIS Abstract] Fluctuating asymmetry was evaluated in samples of house mice that had been living in five population centers of the Central Ural area. The five population centers from which the mice were sampled represent areas with different levels of chemical and radioactive contamination. Specifically, the mice were trapped in the following areas: the northern part of Yekaterinburg, which contains a large number of industrial enterprises and major highways; the southern part of Yekaterinburg, which has relatively low levels of technogenic pollution; the city of Pervouralsk and village of Novoutkinskiy, which are highly contaminated with chemical pollutants; the village of Rybnikovskoye, which is located within the Eastern Ural radioactive trace; and the village of Sosnovka, which is located near the Eastern Ural radioactive trace. A population of house mice from the village of Sovetskiy in the northern part of Tyumen Oblast, which is far removed from industrial enterprises and major highways, served as controls. Fluctuating asymmetry was analyzed for four bilaterally symmetric craniometric features: width of the parietal bones and lengths of the frontal bones, nasal bones, and incisive foramen. An MBS-9 with a micrometer-eyepiece was used for the measurements. The house mice were also subjected to cytogenetic and morphologic studies. With the sole exception of the mice from the southern part of Yekaterinburg, all of the mice trapped in the Central Ural area had a significantly increased frequency of chromosome aberrations in their bone marrow. In most cases, however, the levels of fluctuating asymmetry observed in the control mice were higher than in the mice from populations subjected to various intensities of mutagens. Only the fluctuating asymmetry values recorded for the width of the parietal bones of the mice from Pervouralsk and Sosnovka were somewhat higher than the values recorded for the mice trapped in Sovetskiy. In contradiction to the generally accepted idea that exposure to environmental stress generally results in developmental disorders such as fluctuating asymmetry, no increase in fluctuating asymmetry was observed with respect to any of the four craniologic indicators studied among any of the five populations of mice from contaminated territories. In fact, levels of fluctuating asymmetry of the frontal and nasal bones were lower in animals from territories with higher levels of contamination. Two possible explanations for the lower-than-anticipated incidence of fluctuating asymmetry among animals with an elevated incidence of chromosomal aberrations were offered. First, it was suggested that the incidence of fluctuating asymmetry might indeed be increasing as levels of environmental contamination increased but that this increased incidence in fluctuating asymmetry was overshadowed by other environmental contamination-associated processes with the opposite effect on ontogenetic homeostasis. Allele diversity and heterozygoticity associated with long periods of exposure to mutagens were cited as examples of factors that might overshadow an increased trend toward fluctuating asymmetry. Second, it was hypothesized that a decrease in the level of fluctuating asymmetry under the conditions existing in the Central Ural area may be caused by strict constraints with respect to ontogenesis that cut off marginal variants of individual development that are within normal population ranges in the absence of stress and that thus increase the variance of fluctuating asymmetry under normal conditions. Table 1; references 11: 3 Russian, 8 Western.

Using Recombinant Herpes Simplex Type 1 Virus To Deliver Genes to Neurons

957C0072A Moscow USPEKHI SOVREMENNOY BIOLOGII in Russian Vol 114 No 5 Sep-Oct 94 pp 595-607

[Article by O.E. Tolmachev and T.O. Tolmachev, Genetics and Commercial Microorganism Selection State Scientific Research Institute, Moscow; UDC 578.825.11:577.25]

[FBIS Abstract] Like other neurotropic viruses, herpes simplex virus type 1 [HSV-1] is capable of moving through neurons by using intraneuronal systems of anterograde and retrograde transport. Unlike many other many neurotropic viruses, HSV-1 contains DNA rather than RNA as its genetic material. For this and the following additional reasons, HSV-1 is well suited for use as a vector for delivering genes to the nuclei of neurons: the main route of propagation of HSV-1 infection in vivo is through the nervous system; many HSV-1 genes are unnecessary for productive development of the virus and may therefore be replaced by foreign DNA; a DNA sequence may be packed into the HSV-1 capsid as long as it contains a specific *cis*-element from the *a* repeat and is about 150 kb long; preparations of HSV-1 and its recombinant derivatives may be produced with a high titer (10^9 blast-forming units); and HSV-1 may exist in neurons in a latent state and as an episome in several other types of cells. On the other hand, the following factors have complicated the use of HSV-1 as a vector to date: the virus may be toxic for cells because it induces specific impairments in the synthesis of cell macromolecules and it can affect the structure of the host cell's DNA, alter the transcription activity of cell genes, and inhibit translation of mRNA; HSV-1 may induce oncogenesis; HSV-1 can only remain stable or nontoxic in

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selected neuron populations; HSV-1 is capable of reactivation from its latent state; and the vectors introduced into genes may not express themselves because the promoters of many foreign genes do not function during the course of productive or latent infections and the promoters' activity depends on whether specific regulator elements are present within them and on their position within the HSV-1 genome. Vectors obtained on the basis of HSV-1 have been used for short- and long-term expression of foreign genes in neurons both in vitro and in vivo. Long-term expression may be observed if the recombinant virus is defective or in a latent state, and virus and cell promoters may be used for expression of foreign genes. A virus LAT-promoter forming latent-state RNA and several foreign promoters may be used for long-term expression of foreign genes in nondefective genomes. In a number of virus genes, mutations may be obtained that reduce the virus's toxicity and attenuate virus replication. It has been demonstrated that vectors with a partial replication defect are relatively nonpathogenic for laboratory animals. It has also been shown that although recombinant viruses with partially impaired replication damage cells to some degree at the inoculation site as a result of productive infection, the formation of new virus particles allows the said vectors to penetrate to different regions of the nervous system. Defective viruses, i.e., those with completely impaired replication, have been demonstrated to be less pathogenic; however, they can only penetrate cells that are in direct contact with the virus-introduced inoculate. Vectors based on HSV-1 are have been concluded to be promising for use in studying the following: topography of neuronal networks, mechanisms of intraneuronal transport of macromolecules, and mechanisms of signal transfer in neurons. The following barriers/drawbacks to using HSV-1 as a vector must also be kept in mind, however: 1) reliable regulation of the level of expression of introduced genes has not yet been possible; 2) genes with partially impaired replication can only be used to deliver a gene to a limited segment of the nervous system; 3) using genes with partially impaired replication makes it possible to increase the number of recipient neurons but causes the death of productively infected cells; and 4) vectors can harm recipient neurons, especially because of the virion's protein components. Table 1; references 71: 3 Russian, 68 Western.

Protein Synthesis in Cerebral Cortex Cells of Rats Subjected to Hypoxia With Interparenchymal Injection Into the Cerebral Cortex of Protein Isolated From Fetal Nerve Tissue

957C0076A Moscow PATOLOGICHESKAYA FIZIOLOGIYA I EKSPERIMENTALNAYA TERAPIYA in Russian No 4 Jul-Dec 1993 (manuscript received 20 Dec 90) pp 11-14

[Article by A.V. Timonin, General Genetics Institute imeni N.I. Vavilov, Moscow; UDC 616.831-008.939.6-02:612.273.2]-092.9-07]

[FBIS Abstract] An activator protein referred to as a "stage-specific protein activator" that appears in the fetal cortex or cerebellum of 8- to 10-day-old rats and that has a molecular weight of 30,000 daltons and an isoelectric point of 6.8 was isolated. Its effect on protein biosynthesis in various rat cerebral cortex cells was then studied in experiments performed on a total of 50 female Wistar rats weighing 180 to 240 g each. The rats were divided into three groups. The group 1 (n = 17) rats were subjected to hypoxic hypoxia in a pressure chamber (pressure, 180 mm Hg) for 3 minutes to damage the neurons of their cerebral cortices. Twenty days thereafter, the rats were given intraparenchymal injections of 30-40 μg of stage-specific protein activator dissolved in 30-40 μg of sterile physiologic solution. The group 2 (n = 18) rats were exposed to the same pressure conditions as the group 1 rats; however, they were not injected with stage-specific activator protein. The group 3 rats (n = 15) were not placed in a pressure chamber and were given intraparenchymal injections of sterile physiologic solution but no stage-specific activator protein. The intensity of protein synthesis in the rats' brains was determined on days 4 and 120 after administration of the intraparenchymal injections (i.e., days 24 and 140 after the hypoxia session). Protein synthesis in neurons isolated from the cerebral cortices of the group 2 rats was lower than that in the neurons of the cerebral cortices of the group 3 rats, thus establishing that exposure to the effects of hypoxia reduces the intensity of protein synthesis in the neurons of animals' cerebral cortices. Injection of stage-specific activator protein into the brains of the group 1 rats stimulated the intensity of protein synthesis in the neurons of their cerebral cortices to the levels observed in the group 3 rats. An examination of protein biosynthesis in glial cells indicated that hypoxia stimulates protein synthesis in the said cells all by itself. Unlike the neurons, the glial cells had virtually no reaction to the intraparenchymal injection of stage-specific activator protein. Biosynthesis processes in the glial cells did intensify as a result of the effects of hypoxia. On day 120 after the one-time administration of stage-specific activator, no changes in intensity of protein synthesis were observed in either the neurons or glial cells of the group 1 animals. Although no statistically significant differences in the intensity of protein synthesis for the neurons isolated from the cerebral cortices of the animals in groups 2 and 3 were found, the level of protein synthesis of the group 3 animals remains slightly higher than that of the group 2 animals. The results of the experiments involving stage-specific activator protein were compared with the findings of experiments in which rats exposed to hypoxia received transplants of fetal nerve tissue. Unlike the stage-specific activator protein, the transplanted fetal nerve tissue affected protein synthesis in both the neurons and glial cells (raising the transplant recipients' protein synthesis levels to those observed in intact animals). Furthermore, the effects of the transplanted fetal nerve tissue were most evident 120 days after the transplantation procedure, whereas the stage-specific activator protein did not have any long-term effect on

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protein synthesis in the cerebral cortex cells. Single injections of stage-specific activator protein thus intensified protein synthesis only in the neurons and only in the early period after administration of the injection. Figures 3; references 12: 9 Russian, 3 Western.

Structural-Functional Characteristics of Regeneration of Severed Sciatic Nerve Subjected to Pulsed Magnetic Field

957C0076B Moscow PATOLOGICHESKAYA FIZIOLOGIYA I EKSPERIMENTALNAYA TERAPIYA in Russian No 4 Jul-Dec 93 pp 29-33

[Article by O.A. Krylov, A.B. Antonov, Z.V. Yeliseyeva, S.N. Malikova, and I.N. Shevelev, Russian Scientific Center for Medical Rehabilitation and Physical Therapy and Neurosurgery Institute imeni N.N. Burdenko, Russian Academy of Medical Sciences; UDC 616.835.8-089.85]-085.847.8-036.8-07]

[FBIS Abstract] A study examined the dynamics of the regeneration of the structural characteristics of severed sciatic nerves subjected to a pulsed magnetic field. Eighteen lightly anesthetized adult male rabbits weighing 2.7 to 3.1 kg each were subjected to operations involving complete severing of the right sciatic nerve at the middle third of the hip and subsequent reconstruction by perineural suturing. After the operations, the rabbits were divided into experimental (n = 11) and control (n = 7) groups. Beginning on day 2-3 after the operations, the rabbits in the experimental group were subjected to a pulsed magnetic field for 8-10 minutes daily for 10 days. A GIM-1 solenoid designed at the Solid-State and Semiconductor Physics Institute of the Byelarusian Academy of Sciences was used to generate gradient pulsed magnetic fields projected onto the severed area of the sciatic nerve from a distance of 5-10 mm from the tissue. The magnetic induction at the center of the solenoid's working surface reached 1.2 teslas, each pulses lasted for 3 ms, and a pulse front rate of rise of at least 10^4 teslas/s was maintained. The rabbits in the control group were subjected to a procedure in which an analogous magnetic field was simulated. On days 15 and 22 after the reconstructive operations, degeneration of the myelinic fibers of the experimental group rabbits was much less pronounced than in the control group rabbits. Specifically, examinations of the experimental group rabbits revealed a decrease in the number of spherical laminar structures present in the lemmocyte cytoplasm of their lemmocytes and the formation of thin myelinic fibers. Examinations of the controls on days 12-22 after the operations, on the other hand, revealed significant quantities of degenerated myelinic fibers evidenced by large numbers of spherical layered structures of different sizes and drops of myelin. Myelin decomposition products were enclosed in special lemmocyte vacuoles or "ovoids." In places, the decomposition products had been resorbed and empty vacuoles were evident. On day 50 after the operation, the pattern of myelinic fiber degeneration in the peripheral segments of controls' sciatic nerves was less pronounced than it had been on day 22. The controls' lemmocyte cytoplasm still contained vacuoles with decomposition products; however, the numbers of such vacuoles were significantly reduced. Nerve fiber regeneration processes were also evident in the controls. On day 50, the experimental rabbits' lemmocytes were free of decomposition product-containing vacuoles; however, some fibers retained signs of degeneration. The experimental rabbits' sciatic nerves contained greater numbers of small- and medium-sized myelinic fibers than did the controls, thus attesting to the acceleration of myelinization processes as a result of exposure to pulsed magnetic fields. Examination of the connective tissue scars of both groups of rabbits on day 50 established that exposure to pulsed magnetic fields results in more directed and faste growth of nerve fibers from the center to the periphery. Microscopy studies of both groups' nerve tissues confirmed that the pulsed magnetic field intensity and exposure times used in the study had no damaging effect on nerve tissues. Figures 2; references 15: 7 Russian, 8 Western.

Iron-Clad Drug

957C0082A Moscow KHIMIYA I ZHIZN in Russian No 8 Aug 94 p 31

[Article by A. A. Shepelev, candidate of engineering sciences; first paragraph is KHIMIYA I ZHIZN introduction]

[FBIS Translated Text]It has been proven that it is theoretically possible to produce a new class of effective drugs technologically.

Alas, the methods of drug treatment of oncological diseases are not effective enough. One of the reasons is that it is not possible to maintain a high concentration of a drug at the site of the disease. The staff of the Institute of Oncology imeni P. A. Gertsen and State Research Institute of Chemistry and Technology of Metallo-Organic Compounds tried to solve this problem on the basis of the following idea: to accumulate the drug at the site of the patient's lesion in the form of microcapsules (i.e., to create a drug reservoir), and to control release of the drug from the reservoir at the same rate as dissolution of the shell of the microcapsule, which is a thin ferromagnetic film. Iron was selected as such a material—it is not carcinogenic and, moreover, is readily excreted from the body.

It turned out to be the most difficult to make a thin magnetic film, 0.02 to 5 μm in thickness out of iron and to use it to wrap dielectric microcapsules containing drugs with a melting point of up to 45°C (the capsule diameter may range from 1 to 10^3 μm). This problem was solved by means of gas-phase metallization: upon decomposition of iron pentacarbonyl fumes by a high-frequency field with a glow discharge fine-grain iron is formed. It remained only to precipitate it on the capsules. This was also done successively, and in such an exquisite manner that the temperature of the drug did

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not exceed 40°C during metallization. Ultimately, specimens of encapsulated cytostatic agents (drugs used for chemotherapy of oncological diseases) covered with a thin film of magnetic iron were produced.

Biomedical trials on animals of encapsulated cytostatic agents consisting of cyclophosphane [cyclophosphamide] and fluorouracil yielded a good therapeutic response: tumor growth was arrested and sick animals survived for a longer time. A comparison to treatment with uncoated cytostatic agents revealed a maximum clinical response with use of acetyl cellulose microcapsules with cyclophosphane (0.2 mm diameter), with coating thickness of 2-3 μm.

These results not only are encouraging with respect to applications, but also reveal a theoretical possibility of developing even more effective drug methods of controlling cancer, and not only cancer. Scientific and practical developments involving physical metallurgy, plasma chemistry, biology and medicine, and in particular the very feasibility of producing thin-film ferromagnetic coatings for drugs, will make it possible to solve yet another extremely important medical problem: the problem of magnetically controlled transport of drugs in a patient, when it will be possible to deliver drugs and keep them at the lesion site by means of a magnetic field.

Role of Periphyton in the Migration of Radionuclides in a Lake Ecosystem

957C0084A Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian Vol 30 No 4 Jul-Aug 94 (manuscript received 25 Feb 93) pp 53-58

[Article by T.A. Makarevich, A.P. Osmapenya, and A.P.Pavlyumin, Belorus State University]

[FBIS Abstract] The flow of $^{137+134}$Cs through theperiphyton block of Lake Svyatskoye in Belorus, located in thezone of the Chernobyl disaster, was studied as a model in 1992. The lake has an area of 7.9 ha and a maximal depth of 11 m. Azone of aqueous vegetation 2-8 m high, the basic substrate forperiphyton, grows along the perimeter of the lake. During a large part of the year a vertical stratification of the water is observed; it is divided into aerobic and anaerobic zones. Hydrogen sulfide exists in marked amounts in the lower levels. Lake Svyatskoye is weakly eutrophic. Chemical synthesis and bacterial photosynthesis, and also the production of periphyton,play an important role in the formation of new organic substances. The radiation level on the lake shores varies from150-300 mcu/hour. The cesium contamination of the soil is 10-20curies/km^2. Determination of the radioactivity of periphyton showed that this community is characterized by extremely high values of specificactivity in comparison with its level for different components of the biota (green Conferva algae, large manna grass (Glyceria),dioecious sedge (Carex), dragon fly larvae, and large pond snails.) Thus, periphyton plays a greater role than other littoral communities in the vital activity process; it finds and accumulates radionuclides entering the catchment basin and also immobilizes them from the water stratum. This characteristic of periphyton makes it very important in the mechanisms of biological self-purification and the migration of radionuclidesin the contaminated waters of ecosystems. The high coefficients of the accumulation of radionuclides by periphyton to a considerable degree are explained by its existence in the boundary zone, but this aspect of the problem has not yet been studied. Periphyton developing on macrophytes are of special interest because macrophytes are the basic substrate for overgrowth in the majority of reservoirs contaminated as the result of the Chernobyl explosion.The relative amount of radionuclides entering from the water and from macrophyte tissues apparently depends on the structure of the periphyton communities. It can be assumed that the weakly adherent layer (as a rule, green and blue-green filiform algae,Desmidiaceae, etc.) actively accumulates biogenic elements and radionuclides from the surrounding water, but the strongly adherent layer (primarily diatomaceous algae) to a high degree consume them from the plant host. These processes lead to high accumulation coefficients and levels of specific activity. A large amount of the highly radioactive organic matter produced by periphyton organisms escapes into the suspension and is included in the biotic cycle through the food chains of the filtrates, and by decay, detritus formation, and sedimentation. The mechanisms of the conversion of periphyton into suspension may be the following: washout by hydrodynamic action, removal of overgrowth as the result of liberation of gas in the period of intensive photosynthesis, extraction by invertebrates and fish,and formation of a finely dispersed highly radioactive suspension in the process of detritus formation and washout. The amount of periphyton in Lake Svyatskoye is calculated to be12.4 g/m^2, or 10606 kg for the whole lake. The$^{137+134}$Cs in the water comprises 3.0 x 10^{-7}curies/m^3, but in the whole lake comprises 13.1 x 10^{-2} curies. This means that in 1992 the periphyton contained 11.5 percent of the total radionuclides inthe lake, compared to about 30 percent in the 1991 vegetation season when the level of periphyton growth was considerably greater. In conclusion, the role of periphyton must be considered in the biological purification of water contaminated by radionuclides. This is believed due to its elevated metabolic activity. Periphyton can be used to monitor the radioactive contamination of reservoirs. The advantages of periphyton over plankton ornekton as monitor include active accumulation of a wide spectrum of different radionuclides, the assured complexity of the structural organization of the periphyton community, the large coefficients of the accumulation of radionuclides, and the adherent form of existence. Further study of periphyton is recommended Figures 2; references: 7 Russian, 3 Western.

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Ecological Aspects of the Hydrology of Shatsk Lakes

957C0084B Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian Vol 30 No 4 Jul-Aug 94 (manuscript received 23 July 93) pp 59-71

[Article by V.M. Timchenko, A. Ye. Yaroshevich, Yu. L. Budenina, and S.M. Bezrodnaya, Institute of Hydrology, Ukraine National Academy of Sciences, Kiev]

[FBIS Abstract] Shatsk lakes have been made into a national park for tourists, and agricultural development has taken place in recent decades in the area surrounding them. The effects of this development on the ecology of the lakes and recommendations for improvement are the subject of this study.

Shatsk lakes include 22 lakes with an area of more than 65 km^2 which are located between the West Bug and Pripyat Rivers. Only five lakes are deeper than 2 km, but Lake Svityaz, with a depth of 3.0-4.8 km, is the deepest natural lake in Ukraine. Characteristics of 10 lakes are given in tabular form.

Shatsk lakes have a comparatively stable water level. The highest levels are in April-June. The levels apparently have not been greatly affected by agricultural development but reflect the ratio of the water balance components. The lakes have a weak flow; Lakes Svityaz and Pesochnoye have a water exchange rate of approximately 9 years.

Of the main forms of flow of the Shatsk lakes, the most characteristic is wind. Runoff, gradient, and other kinds of flow have not been observed.

The change in direction and rate of surface drift flow of Lake Svityaz takes place practically simultaneously with the changes in the wind direction and velocity. Inasmuch as the wind here is characterized by instability, flows in the lake are also inconstant. Because of the wind changes, the lake has very complex regions of flow and a complex morphometry, especially in the bottom contour.

The zone of concentration of flows on the western part of the lake and flows going from the southwest to the northeast were studied. With a wind of average intensity (5-7 m/s), the magnitude reaches 300-400 m^3/s. The velocity of the flow may reach 5-10 cm/s. The east part of the lake usually has less intensive counterflow.

Active movement of water masses takes place in Lake Svityaz under ice-free conditions, particularly in the top (10-12 m) layers.

The effect of winds appears to be less by 20-30 percent in some of the other lakes, but the winds cause considerable transfer of water masses along the aquatory.

The winds cause waves, which produce turbulent mixing of waters. The effect of this process on the functioning of the aqueous ecosystems is difficult to evaluate but includes the equalizing of the concentrations of dissolved and suspended substances, the exchange between layers of nutrient substances and the vital activity products of water organisms, the acceleration of self- cleaning processes of reservoirs, and the photosynthesis of phytoplankton. On the average day on Lakes Svityaz and Pulmetskoye the wave height is 10-20 cm, the length is 1.5-3 m, and the period is 0.7-1.3 s. With strong winds the depth of wind produced mixing increases to 10-15 m.

Agitation is less intensive on the other lakes. The current and wave mixing do not only promote equalization of the concentration of impurities and solutions along the aquatoria, but also activate the reservoir self-cleansing processes. Water movement accelerates dilution, decay, neutralization, and hydrolysis of contaminants.

Temperature, suspended substances, and the optical properties of the water masses also affect the quality of natural waters and the habitat of living organisms, and indirectly their activity. The average annual temperature of air in the region ranges from 5.6-8.2°C, and the average for June-August is 17-18°C.

In the depths of Lakes Svityaz and Pesochnoye complete mixture of the water masses occurs only twice a year because of temperature convection. The annual cycle of the thermodynamics of these lakes in the deep parts has six periods: winter stagnation, spring circulation, summer stagnation, and autumn circulation, divided by very short periods of spring and autumn homothermy. In summer stagnation the top layer reaches 10-12 m. Below it is the middle layer with the greatest temperature gradient (the metalimnion). It blocks mass exchange, weakens photosynthesis processes, and limits the production of organic substances by phytoplankton. The lowest layer (the hypolimnion) has a very small lowering of the temperature with depth.

The water turbidity does not exceed 1-3/m^3 in Shatsk lakes. The range is from 1 in Lake Pesochnoye and 1.5 in Lake Svityaz to 4-6.5 in Lake Luk.

The suspended particles of Lake Lyutsimer are 85 percent organic, and of Lake Luk, 65 percent. The least organic is of Lake Pulemets, 13-15 percent.

The Shatsk lakes can be divided into three groups according to transparency. Lakes Svityaz and Pesochnoye are most transparent. All the lakes are extremely vulnerable to any anthropogenic actions related to contamination of waters, the benthos, and biota. Because Shatsk lakes are practically without drainage, contaminants accumulate in the water, bottom deposits, and aquatic life. The mobility of the water determines the neutralization of contaminants. Each lake is different, and this must be taken into consideration in any recreational plan.

It may be possible to regulate a change in hydrological conditions, but for this it is necessary to determine the

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ratio between hydrological processes and the reactions of components of lake ecosystems. This is a subject for further study.

Figures 6, tables 2, references: 15 Russian.

Simulation Mathematical Model of the Distribution of Radionuclides Along the Cascade of the Dnepr Water Storage Reservoir

957C0084C Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian Vol 30 No 4 Jul-Aug 94 (manuscript received 8 Jul 93) pp 90-99

[Article by I.V. Rogal and V.A. Dobrynskiy, Institute of Hydrobiology, Ukraine National Academy of Sciences, Kiev]

After the Chernobyl explosion it became important to predict the migration of radionuclides along the cascade of the Dnepr water storage reservoir and the accumulation of their hydrobiota. Mathematical models are frequently used for predicting these processes because it makes it possible to examine a great number of variables in a short period of time.

The chamber model is used in which a series of volumes ("chambers") are connected sequentially so that the output of one chamber is the input of the next. It is assumed that the whole mass of water is mixed with radionuclides instantaneously. The chambers are connected by means of the overcurrent of water from one chamber to the next, i.e., by launching through the hydroelectric dam.

In the mathematical model used here, it is considered that the degree of contamination of water by radionuclides is measured in concentrations. Processes of accumulation of radionuclides in hydrobiota are considered, taking into account their sedimentation and spontaneous decay.

Four scenarios were considered for the admission of radionuclides into the Kiev water storage reservoir.

Scenario 1. Known concentrations of radionuclides under the usual natural conditions after the explosion enter the Kiev water storage reservoir from Pripyat for a period of a year.

Scenario 2. On a background as described in Scenario 1, of the arrival of radionuclides from Pripyat, at the beginning of the year a definite mass of radionuclides is ejected instantaneously. According to the value, this explosive ejecta exceeds the mass of radionuclides by a factor of 100, entering after January under ordinary conditions at 95 percent water content of the Prepyat River.

Scenario 3. This differs from Scenario 2 only in that the indicated mass of radionuclides instantaneously is ejected into the reservoir not at the beginning of the year but at the beginning of May.

Scenario 4. This differs from scenario 3 in that the mass of radionuclides is equal to the mass of the instantaneous ejecta and enters the reservoir uniformly throughout the whole month of May.

In all calculations, the transformation constant (decay, sedimentation, bioabsorption, etc.) of the radionuclides was assumed to be equal to 0.25. Values corresponding to the level of radioactive contamination of the indicated reservoirs with strontium-90 and cesium-137 were taken as initial data on the concentration of radionuclides in the water of Pripyat and the water storage reservoir of the Dnepr cascade.

In results according to the first scenario, the dynamics of the distribution of the concentration of radionuclides qualitatively on the whole reflects the dynamics of the water system of the cascade. In particular, the maximal concentration of radionuclides in time coincides with the end of the spring adjustment.

Analysis of the second scenario shows the following: 1) the maximal value of the radionuclide concentration essentially depends on the volume of water in the reservoir at the beginning of the year; 2) in the process of radionuclide accumulation for each reservoir a moment in time exists to which the maximal concentration corresponds and which lags in comparison with that in the preceding reservoir; 3) the effect of the water content of the year appears in the fact that the period of self-cleansing, i.e., the decrease in the concentration of radionuclides to the level corresponding to the background which is determined by constantly functioning contamination from the Pripyat is inversely proportional to the water content of the year (the greater the water content, the more rapidly the reservoir will be self-cleansed of radionuclides).

In the third scenario, the picture of the dynamics of the distribution of the radionuclide concentration along the reservoir cascade is qualitatively analogous to that of scenario 2, but in time is four months later.

The fourth scenario is analogous to the third scenario, but the maximal concentration is achieved in the middle of May, and the period of self-cleansing of the reservoir increases.

With the data of the model it is possible to simulate other extremal, in particular, accidental situations. Figures 4; references: 5 Russian.

Privatization in Public Health Care Examined

957C0089 Moscow VRACH in Russian No 3 Mar 94 pp 2-3

[First installment of a two-part article by V. Praznikov, doctor of medicine and president, Interregional Medical Association, under the "Business Club" rubric: "Privatization in Public Health Care"; boldface as published in source text]

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[FBIS Translated Text] In midsummer of 1993, Russia's public health care was once again in a complicated situation: Inflation had eaten up even otherwise meager state appropriations, and medical workers' wages were insufficient to make ends meet. The result was a great efflux of specialists from hospitals and polyclinics to commercial structures, which contributed to the increasing morbidity and mortality among the population. The departure of physicians and nurses was a reaction to changed living conditions, a search for a better lot, and a desire to survive. And no one can blame them.

Understanding all this, the central committee of the medical workers' labor union adopted a resolution regarding preparing for and staging a general strike of Russia's medical workers. It seemed that there was no other way out. And so there was another strike. What did we expect from it? You will recall that there had already been a general strike of medical workers at the beginning of 1992. That strike was organized and staged not just by the labor union but also by the Russian Physicians' Association. For the first time, medical workers took to the streets to ask the government to raise their wages, change policies in the sector, and improve its financing. Pickets stood in front of the polyclinics, and television cameramen shot footage of the discontented demonstrators—physicians and nurses. All of that took place and with no results.

In September-October, the situation repeated itself because medicine was and still is an outcast in our society. The notorious residual principle of financing has not improved the state of things. And it will not improve things.

Where is the way out, or is there one at all? It can be said with certainty that even now, in our days of difficulty, a fundamental change in the situation is possible. But based on different principles.

Russia has embarked on the path of a market economy, and many sectors of the economy that were previously government subsidized now earn their own money. Things should be changed so that medical workers too will not walk around with their hand held out; not organize demonstrations, strikes, and other acts of protest; and have an opportunity to earn their own living.

A physician is not a freeloader. The time has come to remember that he provides the most valuable services—services protecting human health—and that he should have the right to sell his labor on the Russian market. In other words, medicine should be included in the sphere of a market economy. But who will do it and how?

In our country, the Ministry of Health has to date remained the sole body managing public health care.

In all countries with a market economy, the ministries perform only a portion of public health care regulatory functions. Public organizations and state medical associations assume the others. Private hospitals and medical centers that are not subordinate to the ministry of public health care provide half of all medical services; however, physicians understand well that they must look out for their own interests at the legal level and before federal and local authorities. It is for this reason that they have banded together in medical associations.

And in our country? In Russia there is still no private sector in public health care, and so there is no need for a state medical association. But some physicians understand that one must be created even though the social base for one does not yet exist. The Interregional Medical Association, which was established in 1992, is trying to effect a radical change in the nature of Russia's public health care system. Specifically, they are trying to separate private hospitals, polyclinics, and health centers from the government sector through privatization. In a word, they are trying to create the foundation for a medical services market in Russia.

Privatization of medical institutions will not solve the problem in and of itself, however. Physicians working as private practitioners will need a solid legal base protecting their interests. They will have to form the medical services market by themselves. They will have to set prices, set up a quality control system, and organize lobbying of their interests in the structures of authority. And this requires not just banding together but monetary resources as well.

Just what do we have today? Very little. It seems to me that nothing will happen until a majority of physicians realize that their fate is in their own hands. It has become necessary to form corporations of physicians and all medical workers and to transform our public health care based on a market economy.

One practical step along this road is lessening government involvement and the privatizing of the medical industry complex and its facilities. Loosening government ties of property means taking a number of direct managerial functions from the government and transferring them to the enterprise level. In other words, it means substituting horizontal (coordination) links for the system of vertical (subordination) links. This substitution can be accomplished without replacing the proprietor. On the other hand, privatization implies replacing the proprietor by transferring or selling government property to economic entities that then use the property in business activity, assuming full proprietary responsibility for the results of the latter. It is important to mention that changing the form of property does not necessarily mean changing the location of a privatized enterprise (institution or organization) in the system of providing free qualified assistance to a patient.

The essence and procedure of the privatization process has been specified in the Russian Federation law "Concerning Privatization of State and Municipal Enterprises

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in the RSFSR" (dated 17 July 1991), the Russian Federation Supreme Soviet decree "Concerning Delimiting State Property in the Russian Federation to Federal Property, State Property of the Republics That Are Part of the Russian Federation, Krays, Oblasts, Autonomous Oblasts and Districts, the Cities of Moscow and Saint Petersburg, and Municipal Property" (dated 27 December 1991), as well as the State Program for Privatization of State and Municipal Enterprises in the Russian Federation, the Russian Federation presidential edict "Concerning Accelerating Privatization of State and Municipal Enterprises" (dated 29 January 1992) and a number of their legislative acts.

Privatization of public health care presupposes their acquisition as private property by citizens, joint stock companies, and partnerships.

Maintaining and fortifying citizens' health and providing them with necessary treatment and preventive health care is one of the government's main social tasks. The unique role of medical institutions makes privatization of all public health care institutions impossible. On the other hand, privatized public health care facilities should be able to maintain their involvement in implementing government health protection programs within the framework of a system of mandatory medical insurance.

There is no doubt that most public health care institutions should remain government (federal or municipal) property. This is especially true in the case of the regional network of institutions (especially those that are unique for their given territory) intended to provide the public with specialized medical care. This policy also extends to public health care institutions providing emergency and urgent medical care, large oblast hospitals, and clinics and diagnostic centers with a highly developed material and technical base.

The State Program for Privatization of State and Municipal Enterprises in the Russian Federation lists medical institutions whose privatization is either prohibited at the present time or permitted so long as special conditions are adhered to. They include institutions of the sanitary-epidemiological service; institutions for the public's social protection; hospitals and sanitoria for invalids, children, and the elderly; and institutions for the prevention and treatment of mental, nervous, infectious, oncologic, and dermatovenereal diseases, as well as drug addiction and AIDS.

Thus, by decision of the Russian Federation government (governments of the republics included in the Russian Federation), public health care facilities, enterprises, and institutions can be privatized regardless of their departmental subordination. Before the required procedure can be instituted, however, they must all be federal property of the republics of the Russian Federation (except for facilities on the balance sheets of enterprises and organizations).

Before pharmacies are privatized, their activities must be licensed. Privatization of the pharmacy network, as well as privatization of public health care facilities, enterprises, and institutions, with the exception of those specified above and/or those on the balance sheets of enterprises and organizations, is permitted only in accordance with local privatization programs.

The Russian Federation State Committee on the Administration of State Property [Goskomimushchestvo RF] implements privatization in Russia. In republics, krays, oblasts, and cities with populations exceeding 1 million persons, these matters are handled by the given territory's agencies. In addition, committees responsible for administration of property are being created in regions throughout the country.

The Goskomimushchestvo RF makes decisions regarding privatization of federally owned enterprises, and committees responsible for administration of property make decisions regarding privatization of enterprises owned by regions. The property fund (federal, republic, kray, oblast, city, etc.) is the seller of property being privatized. The seller's obligations include publishing announcements regarding privatization of a government or municipal institution, producing (upon the purchaser's demand) the assets of the facility being privatized and documents regarding its finances, arranging the transaction, transferring the enterprise or institution (or property, portions, or shares thereof) to the purchaser, etc.

In accordance with Russia's existing legislation, purchasers may be either natural or juridicial persons. Juridicial persons whose charter capital includes state, municipal, or local authorities, public organizations (or associations thereof), or charitable or other social funds in amounts exceeding 25% cannot be purchasers.

Purchasers may be members of the privatized facility's labor collective. In such cases, they use profits established by law and the State Program for Privatization, and they may form an open-type joint stock company or partnership.

The purchaser of a state or municipal facility becomes the legal recipient of its property rights and obligations in accordance with the conditions of the agreement reached and existing Russian Federation legislation.

The existing methods and forms of privatizing public health care facilities provide for the following:

- creating a market of services in the said social sphere;
- granting collectives of treatment-prophylactic institutions and citizens the right to participate in privatization;
- developing free participation and private property together with a government public health care system for purposes of more completely satisfying the public's need for medical, sanitary-and-prophylactic, and pharmaceutical care.

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The main purposes of privatizing public health care facilities are as follows:

- increasing the operating efficiency of the sector's facilities and the quality of medical services provided to the public;
- social protection of citizens and development of the facilities of the social infrastructure with resources obtained as a result of privatization;
- creation of conditions for competition and concerted action toward demonopolization in public health care;
- involvement of foreign investments in the sphere of protecting citizens' health.

Russian Federation legislation provides for different forms of privatization: auction, competition, acquisition of a share in capital, and leasing. An auction does not require that a purchaser fulfill any obligations regarding acquiring the facility. The right of ownership passes to the purchaser who offered the maximum bid.

A competition is used in cases where the purchaser is required to fulfill specified obligations regarding the facility being privatized, and the right of ownership is transferred to that purchaser who offered the maximum bid.

Acquisition of a share in capital means buying shares of an enterprise (municipal or state) after it has been transformed into an open-type joint stock company. In such cases, only a committee responsible for administration of property or territorial agency of the Goskomimushchestvo RF can be the founder.

Several versions of privatization of state and municipal enterprises exist in Russia at the present time. According to the **first version**, 25 percent of shares are made the property of the labor collective free of charge, up to 10 percent are sold to members of the labor collective by subscription at a discount equal to 30 percent of their face value, and up to 5 percent are sold to representatives of the enterprise's administration at face value. The value of the common shares that can be acquired by members of the labor collective totals 100 percent, and their initial payment amounts to 15 percent of the charter capital.

The first version of privatization calls for selling small enterprises with fewer than 200 employees and a book value (as of 1 January 1992) of no more than 1 million rubles at an auction or competitive sale.

In the case of the **second version** of privatization, up to 51 percent of common (voting) shares are sold to the members of an enterprise's labor collective. The initial payment of the labor collective members to the charter fund of a privatized enterprise should amount to 30 percent, and the enterprise is transformed into an open-type joint stock company. This version is used for enterprises with more than 1,000 employees and fixed assets having a book value (as of 1 January 1992) of more than 50 million rubles.

In accordance with the **third version** of privatization, 20 percent of the charter capital is transferred to the members of the labor collective in the form of voting shares belonging to the respective property funds, whereas 20 percent in sold in the form of common shares at a discount equal to 30 percent of their face value. The initial contribution amounts to 15 percent of the charter capital. The third version of privatization is implemented by any of the established methods and is used for all other enterprises.

The main steps in privatization (formulation and submission of a privatization application, the procedure for the privatization commission's operation, valuation of the property being privatized, and organization of different methods of implementing privatization) are regulated by the existing normative acts.

Privatization in Health Care Examined (Continued)

957C0090A Moscow VRACH in Russian
No 4 Apr 94 pp 2-3

[Second installment of a two-part article by V. Praznikov, president, Interregional Medical Association, under the "Business Club" rubric: "Privatization in Public Health Care"; final paragraph is VRACH editor's note]

[FBIS Translated Text] An initiative for privatization of public health care facilities may originate in local bodies responsible for managing the sector or a medical institution's management or labor collective. A privatization application signed by the director and notarized is submitted in approved form to the rayon or city property management committee or to the territorial agency of the Russian Federation State Committee on the Administration of State Property [Goskomimushchestvo RF] where the public health care facility is located. It is absolutely necessary that notarized copies of the applicant's certificate of registration and constitutive documents be attached. If the decision to privatize is made at a general assembly of at least half the members of a labor collective, the application is submitted in their name. This may be done before the right of ownership is transferred to the purchaser regardless of who individually submitted the application (a natural or juridicial person). To protect the interests of the workers at the facility being privatized, the following actions are prohibited without the approval of the respective committee responsible for administration of the property:

- reorganization, elimination, or alteration of an institution's (organization's) structure;
- alteration or termination of previously concluded leasing agreements;
- alteration of an institution's staff schedule or reduction of the number of workers without the agreement of the labor collective.

The committee that registered the application is obliged to reach a decision regarding the facility's privatization within 2 weeks. The applicant can only be rejected in

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cases stipulated by law. Next, a plan for privatizing the public health care facility is developed that includes specification of its initial price, the amounts of charter capital (of a joint stock company), method of privatization, and form of payment.

After the privatization plan has been approved by the appropriate committee, the treatment-prophylactic institution is included in the plan/chart of competitions, auctions, and stock offerings. The initial price of an institution (organization) being privatized and the amount of its charter capital are established by the privatization commission based on the results of an inventory and property valuation. Included among the property subject to valuation are fixed capital and investments, reserves and outlays, monetary assets, and other financial assets.

When the initial price of a public health care facility is determined (when it is sold by competition or auction and when agreeing upon the amounts of charter capital of a joint stock company), the following items listed as debts on the balance sheet are excluded from the value of the facility's property:

- surpluses of economic stimulation and profit funds directed toward creating an institution's (organization's) privatization fund;
- short-, medium-, and long-term loans; loans not repayed on time; and short- and long-term loan capital;
- settlements with creditors and other debts, specifically borrowed and temporarily enlisted capital.

Also excluded from the calculations are the value of property for which existing legislation has established a special privatization procedure and the value of facilities intended for socio-cultural and social purposes. With regard to the latter, the committee on the administration of property has the right to decide whether to retain them as state or municipal property.

When the amount of a joint stock company's charter capital is determined from the value of an enterprise's property (by the method stipulated above), the following items of debt listed on the balance sheet are also excluded: reserves for upcoming settlements and payments, internal sources of financing capital investments, and incomes of future periods.

The commission for privatization compiles property value estimates reflecting the results of inventory and a total estimate. A list of facilities for which existing legislation has stipulated a special privatization procedure as well as facilities intended for socio-cultural and social purposes that are on a treatment-prophylactic institution's books is attached to the value estimate of the institution's property.

The transfer balance sheet and documents reflecting the inventory results are mandatory attachments to the value estimate of a public health care institution's property. The Goskomimushchestvo RF, its territorial agencies, or the respective committee responsible for administration of property selects the privatization method and form of payment.

When selecting the privatization method, the commission must adhere to the principle of social protection, which guarantees the provision of qualified treatment, preventive care, and medical rehabilitation to the public, and it must consider the social consequences of privatization for individuals living in the given territory and the interests of the medical-sanitary institution's workers. The decision makers are therefore obliged to use the recommendations that territorial public health care bodies have compiled based on careful study and analysis of the activity (infrastructure) of the given region's medical institutions.

Any facility can be sold through two types of auctions: open and closed. An open auction provides for open bidding and is advisable only when selling the assets of enterprises that are being liquidated and that have fewer than 200 employees.

Larger enterprises and blocks of shares of open-type joint stock companies are sold at closed auctions, where closed bids are submitted by potential purchasers.

If state and municipal facilities are being privatized by competition, the winner is obliged to fulfill four conditions:

- continue offering/producing specific types of services, products, and goods and retain the profile of the institution's (enterprise's) operations for a year;
- retain the same number of workers and their social guarantees for a year;
- fulfill obligations regarding the amount of investments in the purchased facility for a year;
- maintain the established level of outlays to facilities belonging to the social sphere and on the enterprise's books for a year.

The thing that arouses the most misgivings in opponents of privatization is the fact that an auction or competition gives preference to the maximum bid offered. There is the danger that public health care facilities will end up in the hands of commercial structures and be reprofiled (even after a year); therefore, auctions and competitions are hardly suitable for our sector. One exception, if you please, could be those institutions (organizations) that do not have a sufficient volume of work and whose services will not be in increased demand for the next 5-7 years.

There is no doubt that the state's priority functions in the matter of protecting citizens' health must be preserved under the conditions of the sector's transition to a market economy. For this reason, the most acceptable form of privatization of public health care facilities should, from our point of view, be that of transforming them into joint stock companies and keeping a controlling block of shares in the hands of the state, which could

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then perform regulatory functions and thereby guarantee the public's social protection.

The sale of shares of joint stock companies or acquisition of a share in capital would occur after the facility being privatized has been transformed into an open-type joint stock company. This is decided at the level of the appropriate committee on administration of property or territorial agency of the Goskomimushchestvo RF. Only a committee on administration of property could found and register a joint stock company.

Once it has been registered, a joint stock company is no longer subordinate to its superior territorial administrative body. The property of the public health care facility that constitutes its charter capital is transferred to the joint stock company's books. In addition, the committee on the administration of property also transfers the following to the joint stock company's books by agreement:

- facilities for which existing legislation has stipulated a special privatization procedure;
- facilities intended for sociocultural and social purposes, as well as other facilities that are state or municipal property.

The charter capital of a joint stock company at the moment of its formation consists of common and preferred shares with identical face values.

The committee on the administration of property transfers the founder's rights and a block of the joint stock company's shares to the corresponding property fund. The property fund has the authority of an owner at all general shareholders' meetings and bears full responsibility for the joint stock company's activity. The controlling block of shares may also be fortified by the state. In that case, the initial agreement stipulates that the property fund include representatives of public health care administrative bodies and officials from the respective facilities' administrations.

Within 1 month after a joint stock company is registered, its labor collective must reach a decision regarding one-time distribution of the transferable preferred shares among the public health care facility's workers free of charge. This policy is also extended to retirees or to those with the right of returning to their previous workplace by law. A list containing workers' names and the amounts of preferred shares transferred to each worker is compiled. Shares belonging to the fund are sold in accordance with the established procedure.

A preferred form of privatizing public health care facilities is acquisition of a share in capital and leasing. In such cases, privatization may be implemented by different methods. If the leasing agreement stipulates that the leasing collective has the right to buy the fixed assets, the purchase is accomplished as follows:

- in accordance with the leasing agreement reached before the Law Concerning Privatization went into force;
- by transforming the state (municipal) treatment-prophylactic institution into an open-type joint stock company with the leaseholder having the right to the first chance to acquire shares belonging to the state or local soviet.

Transfer of a treatment-prophylactic institution to a labor collective free of charge is also possible; however, the economic advisability of such a step should be carefully considered. In practice, transfer of public health care institutions free of charge is only effective in the case of small (primarily outpatient-polyclinic) institutions with a material and technical base that is not well developed (highly worn fixed capital and obsolete equipment and gear).

One of the main task of the commission on privatization is that of determining the forms of payment for a public health care facility that is being privatized. The law regulating the privatization process currently stipulates the following forms of payment:

- direct payment covering the value of the enterprises (or institutions or organizations) being acquired or portions (or rights or shares) in capital of joint stock companies and partnerships either on a one time basis or in installments;
- purchase of a state or municipal enterprise's (or institution's or organization's) property in accordance with a leasing agreement (in which case the lease payment for using the property cannot be counted as payment to acquire ownership of the property).

The form of payment is established in an agreement between the seller and buyer.

In accordance with existing law, if a public health care facility is privatized on account of economic stimulation and profit fund surpluses, privatization funds may be created in which individual personal privatization accounts are opened for workers. These monies are not subject to taxation.

The fact that profit from the sale of a public health care facility's fixed assets and amortization deductions cannot be diverted to such funds must be taken into account.

The procedure for inheritances and gifts applies to the right of ownership in regard to the monies in a worker's individual personal privatization account The owners of such monies can only use them to acquire state- or municipality-owned facilities during the privatization process.

The activity of privatized public health care facilities and the amount and quality of the treatment they provide are monitored by bodies of local authorities and public health care administration of the local administrations (medical insurance organizations).

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It may be anticipated that creation of competition in the medical services market, together with the introduction of principles of medical insurance, will result in greater efficiency on the part of treatment-prophylactic institutions, more rational use of existing resources (financial, material, and labor) and a higher quality of services in state public health care institutions as well.

We must, however, resign ourselves to the fact that privatization of public health care facilities also has negative consequences. The problem is that to date, there has been no comprehensive scientific medico-econmic expert assessment of the concepts of degovernmentalization and privatization of public health care facilities; such an assessment should make it possible to propose an integrated system of forecasts of the medico-social consequences of the said processes for the health of citizens, social groups, and society as a whole.

Editor's note: Russian Federation presidential edict No. 2284, "Concerning the State Program of Privatization of State and Municipal Enterprises in the Russian Federation" was issued while this article was in press. The edict specifies the sequence and priority of the stipulated measures, including those for public health care facilities. The edict develops the privatization of medical institutions in greater depth and strengthens its legal base.

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